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View Showing the Finished Granite Floor and the Concrete Backing, 18 Feet Thick, for the Side Walls.

View Showing the Massive Granite Masonry at the Turn from Floor to Side Wall.

Length on coping, 750 feet. Length on floor, 720 feet. Width on coping, 114 feet. Width on floor, 72 feet. Draft on sill, 30 feet.

THE NEW GRANITE DRYDOCK, BOSTON NAVY YARD.—[See page 341.]

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NEW YORK, SATURDAY, APRIL 29, 1905.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

SUBWAY COMPETITION AND CHEAP FARES.

The citizens of New York must view with great satisfaction the friendly rivalry between the great transportation companies, for the privilege of providing better rapid transit facilities in New York city. The commanding position held by the company which has had the good fortune, or shall we rather say, foresight and courage, to secure the first subway system in this city, has thrown some of the other competing interests into a very natural combination, which cannot but work greatly in favor of the general public. If concessions in the form of continuous trips and cheap fares continue to be offered by these competing interests at the present rate, the new extensions of our Subway system will offer the cheapest, most extended, and most speedy system of transit in the world. There seems to be little doubt that as one result of the competition between the Interurban Company, the Brooklyn Rapid Transit, and the apparently allied interests of the Metropolitan, Pennsylvania, and New Haven systems, it will become possible within a few years' time to travel between the remotest limits of Greater New York for a single fare. This will be equivalent to taking a journey of from thirty to forty miles for five cents; and as far as we know, there is no instance of such cheap travel, nor anything approaching it, to be found in any part of the world.

ANOTHER TURBINE ATLANTIC LINER.

Contemporaneously with the completion of the maiden voyage of the first turbine Atlantic liner, the "Victorian," the sister ship "Virginian" was running her speed trials on the Firth of Clyde, when she developed the very creditable speed of 19.8 knots an hour. Compared with the daily records of the fastest Atlantic liners, this performance is not, of course, remarkable; but when we bear in mind that these two ships were designed originally for a sea speed of about 17 knots an hour, it will be seen that the accomplishment of nearly 20 knots on trial is one more tribute to the capacity of the marine turbine to exceed, when pushed to the limit, by a considerable margin the results for which it is designed. The "Victorian," which was illustrated in our issue of April 8, showed a trial speed of a fraction over 19 knots an hour. The first ocean voyage of the "Victorian," which consumed 7 days 22 hours and 50 minutes, was made under extremely unfavorable circumstances, as she started in a gale of wind, encountered bad weather on the way across, and was obliged to go considerably to the south of her natural course, as far south indeed as the latitude of New York, in order to avoid the icebergs, thereby lengthening her voyage by more than 300 nautical miles. Moreover, it was stated by the captain that the boilers gave considerable trouble by priming. The maximum speed reached during the voyage was 16½ knots. The "Virginian" completed her first voyage under favorable weather conditions in 6 days, 22 hours, and 45 minutes. This is the fastest record. On the important question of vibration, the officers and passengers appear to be unanimous in stating that it was practically eliminated in these ships. This, of course, does not prove that there will be a similar absence of engine vibration when a liner with turbine engines is being driven at the speeds of 23 to 23½ knots, at which the fastest of the German ships have been driven by their reciprocating engines. But it is fair to presume that even at such high speeds the vibration will be confined to that which comes from the propellers.

"CONNECTICUT"-"LOUISIANA" CONTEST.

Although the naval authorities, and particularly those at the New York navy yard, have strongly deprecated the idea that there was any shipbuilding contest going on between the New York navy yard, as builders of the "Connecticut," and the Newport News Company, as builders of the "Louisiana," the general press insists on calling it a contest, and no doubt the general public believes that each yard is exerting every effort to beat the record of the other. As a matter of fact, the private yard is doing its work in the way that long experience and careful management have shown produce the best results, and the navy yard is naturally making full use, in the construction of the "Connecticut," of its modern machinery, improved plant, and more efficient organization.

In the days when the late Rear Admiral Bowles, now president of a large private shipbuilding concern, was chief constructor at the navy yard, he was an earnest advocate of the policy of building some of our warships at government yards, chiefly because it would enable a large staff of skilled workmen to be kept constantly employed, and prevent that continual breaking up of the staff which took place whenever repair work was slack. The Scientific American has always heartily favored this policy, and we have followed with close interest the practical test of the question, which is now being made in the construction of the battleship "Connecticut."

In the early days of the reconstruction of our navy, the vessels that were built in government yards were extremely costly, partly because of the obsolete plant and poor equipment of the yards, and even more because of the fact that the navy yards were subject to political interference, and encumbered with a heavy burden of incompetent labor, which trusted to political "pull" to keep it in place. Although the equipment has been brought up to date, and political interference swept away, the popular idea as to the extravagance and costliness of government construction still survives, and seems to die a lingering death. Hence, it is natural that our very efficient corps of naval constructors are gratified at the present opportunity to prove that work of the highest class can be done as well, as quickly, and as cheaply, in the government yards as in the best private yards in the country.

An excellent opportunity to get the exact comparative figures of time and cost in the construction of the "Louisiana" and "Connecticut" has been afforded by an investigation recently made by the House Labor Committee, appointed to determine the desirability of Gompers's Eight-Hour Bill. The report contains statistical data concerning the cost of the two ships, and we learn that in the construction of the hull the average man at the New York navy yard accomplished as much every ten minutes as the average man at Newport News accomplished every twelve minutes and twenty-five seconds; although in a day of ten hours the Newport News man worked in 0,2 of a pound more than the average navy yard man did in a day of eight hours. The Newport News officials decided that the building of the hull offered the best basis of comparison, and they compiled a statement of the weights of material worked into the hull, and the total time of labor employed on hull construction. The same thing was done in connection with the "Connecticut," by the officials at the New York navy yard. The comparison showed that the average production per man, per hour, on the "Connecticut" exceeded by 24.48 per cent the average production per man, per hour, on the "Louisiana." A further inquiry into conditions at the government and at the private yards, with a view to explaining this remarkable result, elicited the following explanation of the high efficiency shown at the navy yard:

1. Higher rates of wages are paid at the navy yard than by private companies in Greater New York and elsewhere, and the rates of the latter average higher than companies elsewhere.

2. Employment the year around is steadier and more secure than in private yards.

3. The higher wages, shorter hours and steady employment attract the best grade of workmen to the navy yard, where a tacit recognition of an asserted economic theory prevails, that the best workmen cannot be induced to work extra hard without larger pay than the average.

4. Prompt recognition of good work by advance in wages and promotion in grade.

5. A large waiting list of mechanics and others from private shops to select from.

6. The expectation or belief that if the "Connecticut" was built in record time the building of another battleship would be given the Brooklyn navy yard.

7. A zeal generated by the general challenge of the country to the navy yard workmen to make good their claims in this test.

8. Prompt discharge for inefficiency.

9. Dismissal of workmen who could not or would not come up to a required standard of output in quantity and quality.

10. No restriction of output individually or collectively.

11. Loafing, soldiering or "marking time" not tolerated.

12. Workmen required to begin work the moment the whistle blows, and to continue working until the moment the whistle blows at quitting time.

13. Strict technical and exacting supervision of a high order of skill and experience.

14. A desire on the part of naval constructors and workmen to remove an impression of inefficiency growing out of former navy yard construction of war vessels, before civil service regulations controlled employment there.

It is not within our province to enter into the question of the eight-hour bill, and the above tabulated facts are given merely to show what excellent results have been obtained by the methods employed on the navy-built ship.

The building of the "Connecticut" has proved, among other things, that the men, under the system of the New York navy yard, are making more money in a given time; that the government is getting more for its money; and that it is getting it in a shorter time.

THE VANDERBILT WATER-TUBE BOILER FOR LOCOMOTIVES.

The high efficiency shown by the marine and stationary water-tube boiler, and the fact that the fire-tube locomotive boiler has about reached the limit of size compatible with the loading gage of the railroads, have naturally directed attention to the question of the employment of the water-tube boiler on locomotives. Our locomotive builders are approaching the stage at which the question of increasing the power of a locomotive is, broadly stated, one of securing increased boiler power within a given limit of size and weight of the locomotive. A specified number of square feet of heating surface in a properly-designed water-tube boiler has a higher average evaporative efficiency than the same heating surface in a fire-tube boiler; and it is realized that if the water-tube type could be so designed as to comply with the rather severe restrictions as to space and form involved in locomotive practice, it would be possible to secure a more powerful locomotive than could be constructed if the boiler were of the standard locomotive type. Another advantage would be the increased safety of the water-tube type; for an explosion would necessarily be limited in its effects, and could never be attended with the destructive results that follow the explosion of a boiler of the present type.

Although the application of the water-tube boiler to the locomotive involves some careful planning to fit it to the peculiar conditions, there are no insuperable difficulties of a structural character to prevent this being done. At the same time, the cost would certainly not be less (not at least in most of the designs that we have seen) and in some designs it would, undoubtedly, be greater. The chief obstacle to the extended use of the water-tube boiler on locomotives is the fact that a locomotive must be prepared to use, at times, water of a very poor quality, and this alone would prohibit the use of the water-tube type in certain localities. On roads where a uniformly good quality of water can be obtained, this difficulty would disappear.

In this connection we note that a patent has recently been granted to Mr. Cornelius Vanderbilt, for a locomotive boiler of the water-tube type, which presents an interesting study of this problem. The boiler consists of two upper, longitudinal drums, extending the full length of the boiler; a pair of side headers of the same length, and gangs of water tubes disposed in reverse curve form, connecting each drum with its own header. The headers are located above and outside the frames, and a cross-section of the boiler, at any point of its length, shows that its external casing conforms approximately in outline to the cross-section of a Wootton fire-box, the two side headers being located as far out beyond the wheels as the loading gage will allow. That portion of the boiler which lies forward of the firebox is formed with a third and larger header, which is placed intermediately between the side headers, and just above the main frames of the engine. A nest of tubes extends vertically from the two upper drums to this intermediate header, and the products of combustion have to pass through this nest on their way from the firebox to the smokebox. The boiler is carried directly upon an intermediate frame, which is supported on the main frame by chairs, and is tied transversely by a system of struts. To eliminate the stresses due to expansion and contraction, the boiler at certain points is supported on the frames by hinged connections.

Prof. Janssen has laid before the French Academy of Sciences an interesting report upon his recent researches on Mount Vesuvius. There was something fascinating about the way in which the octogenarian scientist described his arduous climb to the very brink of the great crater, and the way in which he extracted gases from its very depths, like drawing water from a deep well with a chain pitcher. His receptacles were sunk to a great depth, and then, by an ingenious arrangement of valves, were opened and closed after taking in gas. These gases will be subjected to special tests, with a view to establishing their relation to the solar emanations and vapors.

OUR HERITAGE OF THE MECHANICAL ARTS.—II.

BY ALEX. DEL MAR, M.E.

Among the mechanical inventions of the Solonic age were the sun-dial and sciothericon, the former to denote the hour at a given place; the latter not only to determine the altitude of the sun, but through that, the latitude of different places. Herodotus credits the sun-dial to Babylonia, while the Bible assigns it to the reign of Ahaz, eighth century. The determination of comparative latitude may have prompted the conviction of a spherical earth, which is awarded by some to Thales, and by others to Abaris, whom Harpocration assigns to the reign of Crœsus. The rudder for ships was another invention of this age. Herodotus saw it applied to sailboats on the Nile; but it was doubtless invented so soon as ships were susceptible of being built strong enough to brave the sea; and this must be assigned to some centuries previously. The same writer, in alluding to the device employed to raise the stones of the Egyptian pyramids, plainly suggests the tripod or crane, and pulley. The canal which ran through Babylon had a drawbridge, which was raised every evening, to stop the passage of pedestrians. In Samos the waters of Metelinous were brought to the city by means of an aqueduct cut through the solid rock, and lined with pipes, though of what material is not mentioned. The turning lathe is of the same (Solonic) age. In Ionia, down to the sixth century, the paper of the biblos (papyrus) was so scarce that all writings were committed to parchment. The common use of papyri cannot, therefore, be assigned in that country to an earlier age. Even down to the time of Demosthenes, a sheet of account paper cost a weight in silver equal to our quarter of a dollar. Definite weights and measures are credited to Pheidon of Argos, eighth century, though they probably came from Phœnicia, and still earlier from Babylon. Among the less important inventions chronicled by Herodotus are butter, soap, beer, refrigerators, and mosquito nets, all of which belong to the Solonic age. During the same period commerce furnished the Levantine world with amber and tin from the North, ivory from the South, spices, frankincense and cotton (byssus) from the East, and silver from the West (Spain). Many of the elements of civilization which these items suggest are to be credited to the invention of iron; for without that indispensable metal, and the reserves of copper and tin, which only iron tools could have laid open, no ship could have been built strong enough to convey them across the seas which they had to traverse from the places of their production.

The inventors of the Solonic period include Periander, Solon, Thales, Anaximander, Pisistratus, Anaximenes, Scylax, Œnopides, Pythagoras, Heraclitus, Parmenides, Aphrodisius, Diogenes of Apollonia, Harpalus, Anaxagoras, Zeno of Elea, Empedocles, Leucippus, Euclid of Megara, Plato, and Xenophon; besides a host of other illustrious names in science, statesmanship, law, and the fine arts. They begin in the seventh and end with the fifth century. In the fourth century they die out. Among the last of them is Eudoxus the astronomer and Scopas the sculptor. Between the Solonic and the Alexandrian age there is an interval of almost a century when the genius of Greece was paralyzed, probably through the deplorable results of the Peloponnesian war. Then all at once it revived, as if by magic. Alexander arose, and by his conquest of the Oriental world he stimulated and left to our inheritance those numerous arts and inventions which distinguish the civilization of Greece and Rome from all others.

The Alexandrian era begins with Demosthenes and ends with Hipparchus, when Greece fell to the arms of Rome, and its glory was permanently eclipsed. No sooner did the soldiers of Alexander distribute into the West the treasures of which they had plundered the Orient, than there arose in Asia Minor, Egypt, and the Greek states a generation of inventive talent such as the world had never yet beheld. Not only the shape, but the circumference, of the earth was determined and measured, its geography extended, its various movements traced with accuracy, and the heavens explored for that larger information upon which rest the foundations of the mechanical arts. While Pytheas explored the seas of the North, Megasthenes traversed the lands of the East, and Theophrastus searched the bowels of the earth for rare minerals. Aristarchus of Samos rose to the sublime height of asserting that heliocentric theory which Copernicus only rediscovered eighteen centuries later, and of computing the comparative dimensions of the heavenly bodies and the immense distances which separate them. It was upon these foundations of physical science that Archimedes based his treatise of mechanics, Euclid of Alexandria found assurances for his system of geometry, and Eratosthenes measured the obliquity of the ecliptic, a degree of the meridian, and, with increased precision, the circumference of the earth. The extraordinary universality of the age is typified by Aristotle, its science by Aristarchus, its mechanical genius by Archimedes, and its refinement by the sculptor of the Venus de Milo.

The inventions of the Alexandrian age were both numerous and varied. Under the Ptolemaic kings of Egypt, ships were built of lengths varying from 312 to 420 feet, the latter carrying 4,000 rowers, 400 sailors, and 2,850 soldiers, altogether more than 7,000 persons in one vessel. Demosthenes mentions a merchant ship which, besides the cargo, slaves, and crew, carried more than 300 freemen as passengers (Boackt, 69). Archimedes built a ship for Hiero of Syracuse, which was provided with dining-rooms, galleries, gardens, fish-ponds, stables, mills, baths, eight large towers, and an engine for hurling stones of 300 pounds weight and spears 36 feet long. Its decks were inlaid with scenes from the Iliad, and it contained a temple of Venus and other wonders. Although this huge vessel may have been more useful as a pleasure boat than a man-of-war, yet the Greeks of this age constructed fighting-ships of scarcely less gigantic dimensions. Not only this, but they accomplished in them the most distant voyages. That of Pytheas to the Baltic has been already mentioned. They also sent ships to the Indies, and several around the Cape of Good Hope, which, after having made the voyage from the coast of Spain, were found wrecked on the shores of Arabia. Eudoxus also made the same voyage, though in the opposite direction. However, this feat had already been performed by the Phœnicians under Pharaoh Necho, 611-605 B. C., and by the Carthaginians under Hanno. The art of sailing on a bowline, or "against the wind," if not also anticipated by the Phœnicians, belongs to the Alexandrian age. The invention of an inclosed basin or dock, for ships, is also of the same age. Philon constructed one at Athens, which harbored a thousand ships. The Maritime Code and the Colossus of Rhodes were of the same age.

(To be continued.)

THE HEAVENS IN MAY.

BY HENRY NORRIS RUSSELL, PH.D.

The evening skies are not as bright as they were a month ago. Orion and Sirius are no longer to be seen, and we have also lost the bright planets which were visible in April. In fact, the present is one of the dullest seasons of the year. The Milky Way, near which so many of the bright constellations are situated, lies low along the northern horizon, and the region which now lies highest in the sky is one where bright stars—and faint telescopic ones too—are much less numerous. Even so it does not lack objects of interest, and there are many things to be seen which are worth looking for.

Let us start our search with that landmark of the heavens, the Great Dipper, which is almost overhead at 9 o'clock on a May evening. Every one knows that the two stars at the front of the bowl are called the Pointers, because their line leads us close to the Pole-star. But this is not the only way in which we may make the Dipper useful in finding other stars. Carry the line of the Pointers in the other direction, and we pass through the southern part of Ursa Major and reach Leo, about half way between its two brightest stars, Regulus on the right and Deuebola on the left. The curving line of the Dipper handle is also a good guide. Extending the curve we come to a very bright reddish star. This is Arcturus, the brightest star in the constellation Boötes, and in the northern hemisphere of the sky. At least it is the brightest to most eyes.

It is a very difficult matter to compare the brightness of two lights of different colors, and such a comparison cannot be made anything like as accurately as in the case of two lights of the same color. Worse than this, different people, though far from color-blind, will differ in matching two such lights. For example, Prof. Young in his "General Astronomy" records that to his eye Vega is decidedly brighter than Arcturus, while most people, including the present writer, see the difference the other way. So it is really hardly possible to say which is the brighter of the two stars.

The comparison is further complicated by the fact that our own eyes are not wholly consistent in this matter. If we have two lights of different colors, say a red and a green one, and match them as well as we can, and then increase them both in brightness, say one hundred times, but in exactly the same proportion, the red light will seem to gain more in brightness than the green one, and it will now appear distinctly the brighter of the two. Conversely, if we diminish both lights equally, the green one will appear brighter than the red.

Of the different colors of the spectrum, the green has the greatest "staying power," surpassing red on the one hand and violet on the other, and also the intermediate colors, yellow and blue, in a smaller degree; so that if we had a line of lights of all these colors, apparently equally bright, and decreased them all in the same proportion, the red and violet would vanish first, then the blue and yellow, leaving the green alone. This curious peculiarity of our eyesight is known among scientists as Purkenje's phenomenon, from the name of its discoverer. It explains some familiar things, notably the almost complete absence of color in objects seen by a faint light, e. g., a landscape in weak moonlight. All ordinary objects reflect light of all colors, but colored objects reflect some colors much better than others, so that we get the impression of the color which predominates in the reflected light. But if the light is very faint, the red and violet light reflected to us will be too faint to see, while the green light, though enfeebled in the same proportion, is still visible. A red object, which reflects very little green light, will therefore appear black in a faint light and, in general, almost all color will disappear some time before the forms of objects are lost to sight.

But we are forgetting the stars. If we extend the curve through the Dipper handle and Arcturus still farther, we come upon a pretty bright white star, which is Spica in the zodiacal constellation Virgo. The other prominent stars of this group form a curving line about half way between Spica and Deuebola. Below Spica on the right is the small group of Corvus, and low on the horizon are some of the stars of Centaurus. Below these, but only fairly visible within the tropics, lies the Southern Cross.

Hydra lies along the southwestern sky, and the principal constellations in the west are Canis Minor, Gemini, and Auriga, all pretty low. Perseus is in the far northwest, and Cassiopeia lies right below the Pole. East of this comes Cepheus, and then Cygnus, not yet fully risen. Lyra is higher up, with Vega conspicuous. The "keystone" of Hercules and the semi-circle of Corona lie between this and Arcturus. Ophiucus and Serpens are in the southeast, and below them Scorpio is partly risen, but the brightest thing in this part of the sky is the planet Mars.

THE PLANETS.

Mercury is morning star in Aries. He is too near the sun to be seen at first, but later he comes into view, being at elongation on the 20th, when he rises about 3:45 A. M. and is easily visible.

Venus is also morning star, close to Mercury, and like him is best seen toward the end of the month, when she rises two hours before the sun.

Mars is in opposition on the 8th. He is in Libra, remote from any bright star, and cannot be mistaken, especially as he is brighter than anything else, even Arcturus.

It is interesting to know that on this occasion the earth comes actually between Mars and the sun, so that as seen from the planet the earth and moon transit across the sun's disk. The earth would appear as a small black dot 32 sec. in diameter—too small to be seen without a telescope—crossing the sun from east to west, a little south of the center and taking about ten hours to traverse the disk. The moon would be a much smaller dot, 8 sec. across, entering on the sun's disk some five hours after the earth and crossing it at the same rate, so that both earth and moon would be seen in front of the sun at once.

Jupiter is in conjunction with the sun on the 4th and is practically invisible this month.

Saturn is morning star in Aquarius. On the 24th he is in quadrature with the sun, rises at 1 A. M., and is due south at 6 o'clock.

Uranus is in Sagittarius, rising about 10 P. M. in the middle of the month.

Neptune is in Gemini, and sets at about 10 P. M.

THE MOON.

New moon occurs at 11 A. M. on the 4th, first quarter at 2 A. M. on the 12th, full moon at 5 P. M. on the 18th, and last quarter at 10 P. M. on the 20th. The moon is nearest us on the 16th, and farthest away on the 1st and 29th. She is in conjunction with Mercury and Venus on the 3d, Jupiter on the 4th, Mars on the 17th, Saturn on the 25th, and Venus again on the 30th. The conjunction with Saturn is quite close.

There were 66,784 cars of all classes in the United States in 1902. Of this number, 60,290 were passenger cars and 6,494 were cars used for express and other purposes. Of the passenger cars, 32,658 were closed, 24,259 were open, and 3,134 were combination closed and open cars, while 239 were combination passenger and express cars. There were 1,114 cars devoted solely to express, freight, and mail business. An interesting development in electric railway service is the construction and equipment of sleeping cars for use on long-distance lines in Ohio and Indiana. The largest number of cars of all classes for any State was reported for New York, the number being 14,040. About half of all the cars in the United States were equipped with heating apparatus, 19,021 being heated by electricity, and 11,128 by stoves, hot water, or other contrivances. Many railways, however, have two sets of cars—one for use in summer, and the other in winter—so that in winter the proportion of the cars in operation equipped with heating apparatus is larger than these statistics would at first glance indicate.

THE VIRGIN LACE (LACE-BARK) OF THE TROPICS.

BY L. LODIAN.

There are in all about half a dozen lace-bark trees in the world, so called because the inner bark yields a natural lace in ready-made sheet form which can be made up in serviceable articles of apparel. Only four of these curious species of trees are of much practical value. Tourists who have stopped at Hawaii or Samoa may recall the lace-bark clothing of the natives—clothing of a neat brown color when new, of remarkable strength and of a fragrant odor, like freshly-cured tobacco leaf. The native "tapa" cloth, as it is called, is made from the bark of the *Brusonetia papirifera*, but is not usually included among the real lace-bark trees.

Of the lace-bark trees yielding a pure, snowy lace of utility, we have on the Pacific side of the hemisphere the *Sterkulia acerifolia* of Australia (also called "flame tree," in allusion to its showy red flower), and in Maori Land the *Plagianthus betulinus*. On the Atlantic side there is only one lace-yielding tree so far known—the *Lageta linteria* of the Caribbean Islands. Of the *Dafne tenuifolia* of South America I have never been able to discover a single specimen, despite careful search, nor have I ever met anyone who has seen the tree growing in South America.

In its natural state the lace-bark is of a most delicate cream-white tint. It is probably a kind of fibrous pith. When the outer bark is removed, it can be unfolded and unwound in one seamless piece, having a surface of a little more than a square yard. Washing and sun bleaching give it a dazzling white appearance. It has a faint, agreeable odor not unlike that of freshly split bamboo. The fabric is airily light. It is used in the West Indies for mantillas, cravats, collars, cuffs, window curtains—in a word, for every purpose that ordinary lace is used.

The specimen here shown thrown over a bust of Washington, which is almost natural size, shows how large is the piece of veiling and how free from flaws. In making up shawls, veils, and the like, it is customary to piece two sheets of lace-bark together. Delicate and apparently weak as it is in single mesh, a bit of lace-bark, if rolled into a thin string, will all but resist human strength to break it. In string, braided, and rope form, it is used for making up the light lace-bark harness of the tropics.

Despite its practical use there is no essential demand for lace-bark any more than for the edelweiss of the Alps. It has been used by the natives for hundreds of years, and yet is comparatively little known to this day. A few specimens of lace-bark articles are believed to exist in different countries of Europe. These were made some hundreds of years ago, yet, although their age is considerable, they are said to be in a good state of preservation.

Lace-Bark Veil, Showing the Natural Fiber of the Tree.

How the Lace-Bark is Unfolded.

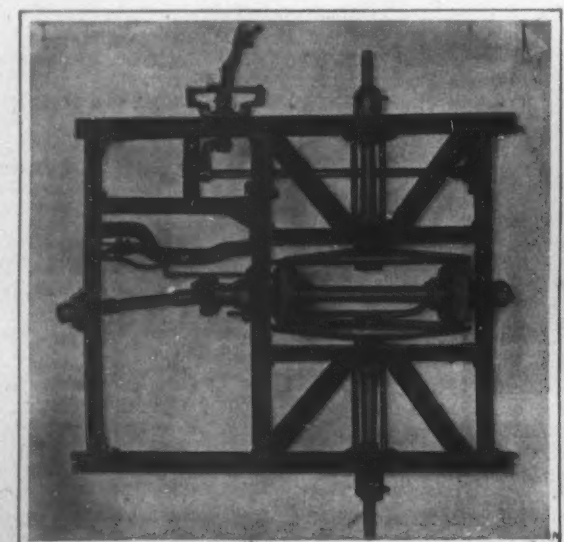
VIRGIN-LACE (LACE-BARK) OF THE TROPICS.

AN EFFICIENT DISK TRANSMISSION FOR AUTOMOBILES.

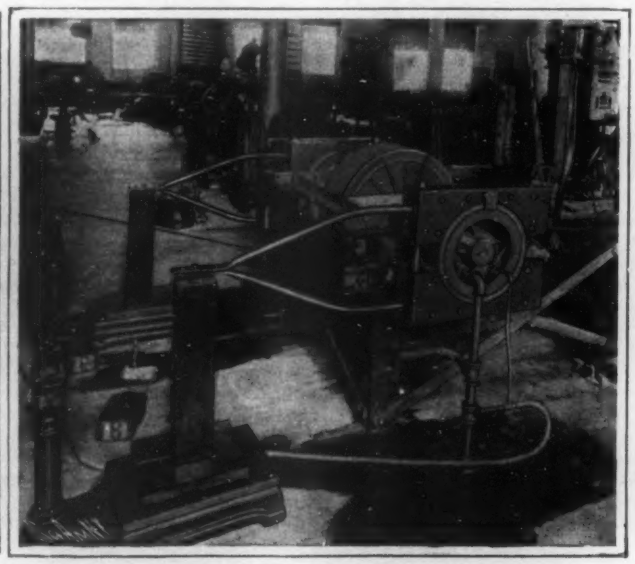
One of the earliest types of variable-speed automobile transmission gears to be experimented with was the friction-disk arrangement, which consisted, generally, of a small friction pulley set at right angles to a large disk (often the motor flywheel) and adapted to be driven by it. By sliding the pulley across the face of the disk from its center outward, any desired speed from zero up to the maximum could be obtained. A transmission of this type, though exceedingly simple and cheap to maintain, had the disadvantage of being decidedly inefficient. It will therefore interest our readers to know that a brake test of a friction-disk transmission of a radically different design has resulted in showing the new type of gear to be even superior in efficiency to the usual three-speed sliding-gear transmission.

The accompanying illustrations give a good idea of the transmission and of the manner in which the brake test was made.

The Marble-Swift transmission is exactly opposite in principle from the usual friction disk transmission just described. Instead of a large disk driving a small friction pulley, the drive is here from a small pulley to a large disk. The pulley is near the periphery of the disk when the driven member is traveling at the lowest speed, and it gradually nears the center of the disk as the speed of the driven member is increased. The result is that the transmission is most efficient at a low speed of the driven member; but there is not as much friction loss or chance of slippage at any speed as there is with the old type. As constructed for an automobile, the transmission has two disks and two driving pulleys mounted on a shaft placed between the disks, and so arranged that one pulley contacts with one disk and the other pulley with the other disk. The pulleys can be approached to each other or moved apart by means of a rack device, and thus various speeds can be obtained. The transmission can be thrown out of gear by setting the shaft so that neither pulley contacts with its disk. The reverse is obtained by making each pulley contact with the disk opposite to the one against which it usually rubs. A universally-jointed driving shaft runs forward from the pulley shaft to the motor, while the driving sprockets for the two rear wheels are placed on the ends of the two disk shafts. No differential is found necessary, as the differential motion is allowed for by a slippage of the friction pulleys. The disks are made of steel, and the pulleys of compressed paper. The wear is inappreciable over long periods of time; but the most interesting feature of the transmission is that it is quite efficient. Our other photograph shows the apparatus used in making the brake test of this gear. Water-cooled brake blocks were placed on the end of each disk shaft, and the driving pulleys were connected to an electric motor. The pull on the brake blocks was accurately measured by means of horizontal arms bearing on posts placed on platform scales. The motor was run at a constant speed of about 800 R. P. M., and the power supplied was accurately measured and corrected for motor efficiency, as determined by a subsequent brake test. The friction gear used in this instance had 6-inch driving pulleys having 1⅛-inch face, and the disks were 19 inches in diameter, which permitted of a wide variation in speed. The sliding-gear transmission, which was tested at the same time, gave a speed reduction of 8 to 1, 3½ to 1, and 2 to 1, respectively. The average efficiency of all the tests was 84.6 per cent for the friction-disk transmission and 82.05 per cent for the sliding-gear transmission. Two sets of tests were made of each at loads of 7 and 10 horse-power, and for the different ratios of speed reduction. The highest efficiency shown by the sliding gear was 84.4 per cent, under a load of 7.06 delivered horse-power, while the highest efficiency shown by the friction-disk transmission was 87 per cent when delivering 10.05 horse-power. The efficiency of the sliding gear varied from 80.5 per cent on the first speed, when driving the brake pulleys 101.5 R. P. M. and delivering 10 horse-power, to 83.9 per cent at 404.5 R. P. M. and the same delivery of power; while the friction-disk transmission varied from 87 per cent at 256 R. P. M. and 10.05 horse-power to 81.9 per cent at 425.5 R. P. M. and 10 horse-power. It will thus be seen that the friction-disk gear is, as stated above, more efficient at low speeds, where all the power that it is possible to develop is needed, while the sliding-gear transmission is the more efficient on the high speed, which is obtained with a direct drive through bevel gears. The advantage of the disk transmission in doing away with all gears, even to those of the differential, is quite pronounced. The disadvantage of great friction losses seems to have been done away with. The tests were made at the Armour Institute of Technology, Chicago, and were thorough.



Plan View of Transmission; Showing Large Disks Driven by Small Pulleys.



Making a Brake Test of the Friction Disk Transmission.

AN EFFICIENT DISK TRANSMISSION FOR AUTOMOBILES.

THE COOPER HEWITT MERCURY VAPOR CONVERTER.

BY A. FREDERICK COLLINS.

The extended use of electric vehicles in cities has heretofore necessitated an equipment comprising a motor generator set in garages where an alternating current only was available, but these electro-mechanical combinations are not only costly in their initial installation, but in their upkeep as well, since any machine having revolving elements is subject to wear, requires oil and more or less attention. Herein lies the merit of the mercury vapor converter, for it has no running parts, being purely an electrical device, has a higher efficiency than a motor generator set, and requires no attention whatsoever. The direct current from the converter may ordinarily be used for any purpose for which a direct current is suitable, but various apparatus require different arrangements of circuits.

While the converter lends itself admirably to the operation of vapor lamps, etc., the commercial converter shown in the illustration is intended for charging storage batteries and for electrolytic work, though it will operate on a resistance load, such as incandescent lamps, very nicely. The outfit can be readily installed in any garage or automobile stable where only alternating current is available.

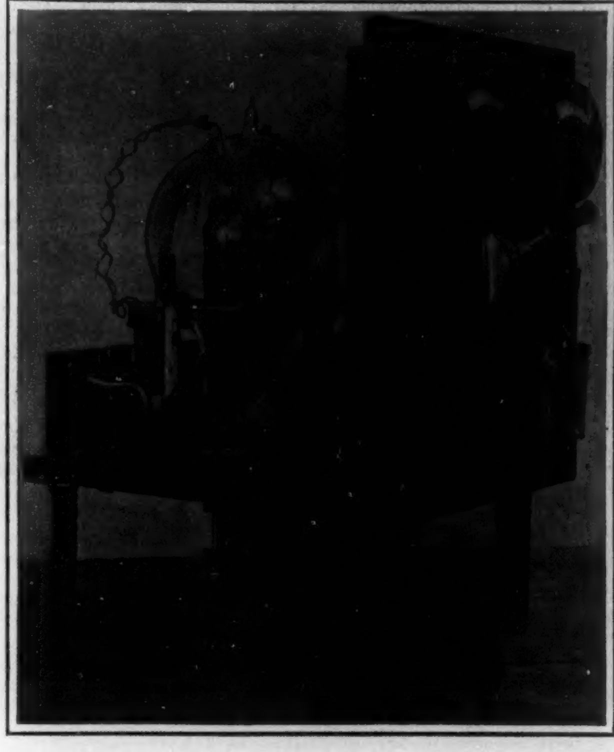
As there are practically no movable parts, the chance of anything getting out of order is reduced to a minimum and hence the converter will be found a simple, convenient, and feasible means for charging electric vehicles. The apparatus may be left running over night provided the batteries be not overcharged thereby.

The mercury vapor converter is automatic, namely, it starts on the closing of the alternating current and direct current switches. Should the converter go out, for any reason, it will start itself again provided the conditions of voltage, etc., are such as to make its operation possible; in other words, the apparatus may be left running with the assurance that, should it go out through any momentary failure of the alternating current supply, it will start again of its own accord on the return of voltage.

The apparatus may be made non-automatic by the opening of a switch, the current may be adjusted while running throughout the full range, and, further, it will operate through any reasonable range of voltage, rendering the equipment a stable and practical affair.

The converter consists of a glass bulb about 9 inches in diameter mounted in a suitable holder, which is entirely inclosed, with a small switchboard mounted in front. On the front of the board are placed a direct current ammeter, voltmeter, two double-pole switches, and a regulator to give current adjustment. The entire apparatus occupies a space of about 15 inches wide by 2 feet long by 20 inches deep; it can conveniently be placed on the floor or mounted against the wall.

With alternating current voltages not exceeding 400 volts, an auto-transformer is used for obtaining the proper potential for operating the converter. On higher voltages a transformer with separate primary and secondary is used. The maximum capacity of the converter is 30 amperes, continuous running, and the converter is adjustable to as low as 6 amperes. It may be adapted to any current up to 115 volts. Its efficiency is, at 30 amperes and 115 volts, approximately 90 per cent; and this efficiency tends to increase as the current falls off. The apparatus is designed for any single-phase constant-potential supply circuit of 60 cycles. In its general characteristics the converter has features in common with the mercury vapor lamp. In both devices the voltage is nearly constant for current of any amperage until a certain very small value is reached. Unlike the lamp, however, the purpose of the converter is not to give light, and so the distance between its metal positive and mercury negative electrodes is made exceedingly short and by this means the potential is reduced to about 115 volts.



COOPER HEWITT MERCURY CONVERTER FOR CHARGING STORAGE BATTERIES.

Where heavy currents are converted heat is developed to a considerable extent, and this naturally means loss of energy; to circumvent this undesirable condition the globe or container is given a large diameter and in this way a larger cooling surface is obtained. While the converter is in operation the mercury is carried upward in the form of a vapor, and this on condensing falls to the bottom again.

The converter just described is another practical application of a new series of distinct phenomena that have been evolved by Mr. Hewitt in the physics of electricity, of which the first is his well-known mercury vapor lamp.

NEW MASONRY DRYDOCK AT THE BOSTON NAVY YARD.

The handsome stone-and-concrete drydock recently completed at the Boston navy yard is one of the largest docks in the world, and has taken about five years to construct. It embodies all the modern improvements which have been incorporated of late years in first-class dock construction, and it is built on such excellent natural foundation, and of such first-class materials and workmanship, that its period of life may be looked upon as practically indefinite. Not always has the United States government built its drydocks as wisely and well as this one has been built. For a period of many decades the navy was, unfortunately, obliged, by ill-advised motives of economy, to build its important drydocks of timber; and although some of these have given good service, others have been exceedingly troublesome, mainly because of leakage; the most notable case being the big drydock No. 3 at the New York navy yard. All of these docks, moreover, are, from the nature of the material of construction, perishable; and there must be a constant element of expense attached to them because of continually-recurring repairs and renewals.

The new dock has a total length on coping, from head to outer end of table, of 788 feet; from head to outer gate sill of 750 feet; and the length on floor, from head to outer gate sill, is 729 feet. The width on the

The Finished Dock from the Harbor.

View Looking from the Dock Bulkhead.

Entrance and the Inner and Outer Abutments, Which Receive the Caisson Gate.

Looking Toward Dock Entrance.

THE NEW GRANITE DRYDOCK, BOSTON NAVY YARD.

coping is 114 feet, and the width on the floor of the body of the dock is 72 feet. The depth from the coping to mean high water is 5 feet 2 inches, and the depth of water over the sill at mean high water 30 feet.

The site selected for the drydock was an old basin that had been used in the earlier days of the dock-yard; and, of course, this made a considerable reduction in the amount of necessary excavation. The site, moreover, was fortunate in being founded everywhere upon a very good quality of hardpan; and although the specifications called for piling where it was necessary, the foundation, as the work proceeded, proved to be everywhere so good, that no piling whatever was used. The excavation was carried on, first by means of scrapers, and then by floating dredgers working inshore from the water front. After the dredgers had taken out the material to a certain depth, a massive bulkhead was carried across the entrance to the excavation, the water pumped out, and the excavation carried on, in the dry, by means of derricks and by hand labor, down to the subgrade. This bulkhead was one of the most important features of the work. It necessitated the driving of two lines of 12 x 12 tongued and grooved sheet piling, spaced 30 feet apart, and the filling of the interval with clay. The sheet piling was driven down to a firm bottom, and the whole structure was thoroughly stayed and braced. In spite of the great hydraulic head, when the excavation had been carried to its lowest depth of nearly 50 feet below extreme high water, the bulkhead remained tight, with the exception of some trouble at one of the abutments which was ultimately remedied. The total width of the dock excavation was about 130 feet, and its greatest depth over 50 feet.

The masonry portion of the structure consists of a monolithic mass of concrete covering the whole of the floor and the sides of the dock, upon which is laid the cut granite facing which forms the finished interior. On the floor, the concrete has a maximum depth below the keel blocks of 11 feet, and the maximum thickness of the concrete in the side walls is 18 feet. This granite masonry is 4 feet in thickness over the floor and has a maximum thickness of 7 feet in the side walls and altars. The masonry of the walls and entrance of the dock is of ashlar, in continuous courses. The beds and joints are smoothly dressed in true planes to form ⅜-inch joints. All of the stonework is laid in Portland cement mortar, made of one part Portland cement and two parts clean, sharp sand, and all joints between the ashlar and concrete packing are thoroughly filled with mortar and grouted up at every course. The coping stones are 2 feet in thickness, 3 feet in width, and never less than 4 feet in length. The concrete backing consists of one part Portland cement, two parts sand and five parts broken stone or gravel. The keel blocks, bilge blocks, and bilge block slides are of oak. In the building of the dock it was necessary to excavate 170,000 yards of blue clay and hardpan, and to build in place 61,800 cubic yards of concrete and 21,000 cubic yards of cut granite. The finished dock is a splendid piece of work, and, as can be seen from our photographs, the lines of the granite work are particularly true and fair.

The caisson for closing the dock is a steel vessel, 104 feet 2½ inches long, 22 feet in molded breadth, and 36 feet 5 inches in depth from bottom of keel to under side of upper deck. It is designed to be in stable equilibrium on an even keel under all conditions of flotation or submergence. It is fitted with a centrifugal pump, boiler, vertical engine, feed tank, gate valves, capstans, and the other fittings and furnishings of a dock caisson.

The pumping plant for emptying the dock is located in a well, which is 45 feet in diameter and whose concrete base is 60 feet below the coping of the dock. The installation in the well consists of two 48-inch centrifugal Morris pumps, driven by two 500-horse-power Westinghouse induction motors, which can develop, if necessary, as high as 750 horse-power each. These are the main pumps and motors for emptying the dock. In addition to these there are two 12-inch Morris drainage pumps, driven by two 75-horse-power vertical-shaft motors. The contract requires that the dock shall be emptied in three hours. This pump well also serves another dock, known as No. 1, which is very much smaller than the new dock. In order to pump the two docks there is a complicated system of piping and valves installed below the floor level of the well. The power house for supplying the current is located about 2,000 feet from the well, and because of the dampness in the well, it was decided to step down the 2,200-volt current to 220 volts for the motors. This is done by three 275-kilowatt transformers, which are also located in the well. There is also a 20-horse-power motor, direct connected to a five-stage centrifugal Worthington pump, which supplies water for the operation of the hydraulic valves. When we bear in mind that the well is only 40 feet in diameter, it can be seen that we have here quite a remarkable aggregation of machinery for the very limited space in which it is installed.

In conclusion we express our indebtedness to Lieut. C. W. Parks, the engineer in charge of this work at the Boston navy yard, for many courtesies extended during the preparation of this article.

A New and Simple Welsbach Lamp.

Quite recently there has been introduced in France and Germany a new form of portable lamp, as compact and light as an ordinary kerosene lamp and more easily operated, which has for a fuel supply wood alcohol.

The burner, as compact as the usual kerosene burner, and adapted to fit any regular fount, is of a novel regenerative type, to which the wood alcohol is conducted by a wick. The latter needs no trimming, as the alcohol by the heat is gasified, and then being mixed with air, produces an intense flameless heat above, which renders brilliantly incandescent the usual netted Welsbach mantle, suspended from above and inclosed in a cylindrical slender glass chimney similar to the student lamp type.

This gives in very small compass an intense illumination, equal to forty-five candle-power with the small mantle, and a smokeless light of remarkable steadiness and brilliancy, and which can be perfectly regulated, with the advantage of being odorless even when lowered to bare incandescence.

One of the points of novelty is an automatic device for feeding a minute quantity of alcohol from the fount to the burner in starting, which is done much in the same way as the usual mechanical extinguishing devices are operated on kerosene lamps. The small amount of alcohol thus brought up is simply ignited by a match, as in an ordinary lamp. In about a minute the light burns brilliantly.

On the Continent, where alcohol is made cheaply, a source of illumination is produced fully as economical as kerosene, and much more easily handled.

It has been stated that in this country it is possible to produce wood alcohol more economically than in Europe, because of our large forests, which form an abundant source of supply of wood.

As a light for photographic and projection purposes, it becomes very efficient, inexpensive, and convenient.

The Drydock at Sparrow's Point.

If man reckoned the size of the "Cavite" floating drydock, which the Maryland Steel Company is building for and will deliver to the United States government early next month, as he measures land, he would say that this big and curiously formed vessel had a superficial area of a trifle more than 1½ acres, for, from stem to stern and from port to starboard, the dock covers a marine equivalent of that space.

Nor is its "ground plan" unrivaled by the altitude of its steel walls, which rise some 64 feet from its as yet unbarnacled bottom, towering 58 feet clear above the rippling waves when the dock is without a burden. These side walls approach in breadth the great stone barriers the Mongolians built to keep out the northern invader, and upon which, we are told, two chariots could be driven abreast. Upon the 14-foot wide top of the dock's tall sides automobiles could race side by side from end to end of the craft; or two mogul locomotives harnessed to trains of cars each 500 feet long could stand together on each of the walls without causing the dock the least inconvenience. Then there is sufficient space between the walls to allow a three-ring circus to exhibit.

Early next month the dock will be floated and towed to a point in the Chesapeake Bay where the Navy Department will have in waiting the largest available battleship to make a test of the new dock.

The "Cavite" in service will have its own complement of officers and crew and these will be quartered as comfortably as if they were on any other vessel of the navy. There are staterooms and mess halls for nine officers and twelve men within the big side walls and there is a finely equipped library and a well appointed kitchen. A complete machine shop is one of the most important accessories and the equipment of this will be sufficient to permit the replacement of any part of a ship's machinery. Indeed, there will be material and apparatus enough in the shop to build a moderate sized vessel outright. All apartments of the dock are provided with electric lights, and there is a distilling plant for securing fresh water for cooking and drinking purposes. The dock has its own compressed air outfit for the manipulation of pneumatic tools used in repairing ships.

This marine giant will cost $1,147,000 and this government rates itself fortunate in getting the dock at such a favorable figure.

In building it there has been used 11,000 tons of steel, held together by more than 2,000,000 rivets. One hundred and thirty tons of red lead and linseed are being used to paint it. Its construction gave work to 300 men.

The length over all is 500 feet, with a width of 100 feet between benders, and a width over all of 134 feet.

The side walls stand 42 feet high clear of the pontoons and are 46 feet high from the bottom. The thickness of the side walls is 14 feet.

The pontoons, which form the base or hull of the dock, are 18½ feet deep.

The dock when floating light draft will draw but 6½ feet of water, but must be in 63 feet of water to give a draft of 30 feet above blocks for any vessel which it may be desired to block.

It has an extension feature by which arrangement sections may be built at any time and attached to it, thereby increasing its length as much as may be necessary. It is also self-docking, for the side pontoons can be sunk separately, each in turn raising the opposite side free from the water so the bottom may be cleaned, scraped, and painted.

The next largest floating drydock in the world is the Algiers dock, which was also built by the Maryland Steel Company and is stationed at New Orleans. It has a lifting capacity of 17,500 tons.

The Bermuda dock, which was built in England, has a lifting capacity of 16,500 tons. The Pola dock, owned by Austria, has a capacity of 15,000 tons. The Stettin dock, owned by Germany, has a capacity of 11,000 tons. The Pensacola dock of the United States government, and formerly located at Havana, is 450 feet long, with a lifting capacity of 10,000 tons.

The Current Supplement.

The current SUPPLEMENT, No. 1530, opens with an interesting description of the first Philippine electric railway. Excellent illustrations give one an idea of the difficulties encountered. A *résumé* of Sir Oliver Lodge's paper on what he quaintly terms "A Pertinacious Current," is published. For the benefit of our readers, it may be stated that a pertinacious current is a continuous unidirectional discharge of electricity, obtained without cells, and under an E. M. F. so high that ordinary big resistances are easily overridden. We hope shortly to publish Sir Oliver Lodge's paper in full. Mr. Howard B. Dailey tells how to make an oscillating static electric motor, than which there is no adjunct of the influence machine that affords a prettier or more striking experimental demonstration of electrostatic attractions. Dr. Oskar Nagel writes on suction gas producers. A new hot-air engine is described by G. Emil Hesse. Charles F. Scott tells how to remember the wire table for the B. & S. gage. A *résumé* is presented of Prof. E. B. Poulton's lecture on Huxley and Natural Selection. Some new apparatus for recording the vibration of railway cars is described by Emile Guarini. The second installment of Mr. Alfred J. Hipkins's paper on "Musical Instruments: Their Construction and Capabilities," is published. "Flower Mimics and Alluring Resemblances" is the subject chosen by Percy Collins for an interesting illustrated article.

Tests of Animal Strength.

Two of the Barnum & Bailey show elephants broke the pushing record on April 16. Last year the same elephants pushed a big circus wagon containing twenty men until the rope, fastened to its axle and connected with a steel spring, sent the indicator on the test gage up to 6,500 pounds.

This year the same animals pushed until the gage showed 8,200 pounds. The wagon weighed 4,500 pounds, and it was estimated that it required a force of 1,200 pounds to move it. One elephant alone scored 7,200 pounds, and in pushing and pulling 6,000 pounds. Seventy-five men pulled 8,000 pounds and four horses pulling sent the gage up to 6,000 pounds on both the long and the short pull. Two camels were able to pull only 2,000 pounds.

The following interesting table shows the results of last year's tests compared with those of this year:

	1904. Pounds.	1905. Pounds.
One hundred men pulling	6,700	——
Seventy-five men pulling..........	——	8,000
One elephant pulling	8,750	6,000
One elephant pushing	4,500	7,200
Two elephants pushing	6,500	8,200
Two horses, short pull	3,750	3,000
Two horses, long pull..............	2,750	2,500
Four horses, long pull	5,125	6,000
Four horses, short pull	5,760	6,000
Two camels pulling	2,750	2,000

A prominent French automobile engineer recently stated that it would not be possible for a modern racing automobile to exceed the speed of 130 miles an hour while it is maintained at the present weight. M. Serpollet, the designer of the well-known steam car of that name, has therefore decided to approach this maximum as near as possible during this year. He is now constructing a steam car which he is confident will accomplish the kilometer in 18 seconds, or at an average speed of 125 miles an hour. The motor will develop over 200 horse-power, and the weight of the engine without the steam generator or boiler will be only 150 kilogrammes (330 pounds).

HOW HYDROGRAPHIC CHARTS ARE MADE.

BY FELIX REISENBURG, LATE OF UNITED STATES COAST AND GEODETIC SURVEY.

THE casual observer looking at a coast sheet chart as published by the United States Coast and Geodetic Survey, or, for that matter, any ocean chart, is often puzzled to know the meaning of the various numbers that dot the water surface of the chart. The amateur sailor, of course, knows that they are soundings, which means the depth of water, but he, as well as many of his professional brethren, is often more or less in the dark as to how the depths and their exact locations are obtained. The soundings that appear on the finished chart are only the characteristic soundings and show the least depth of water to be expected. They represent but a small percentage of those actually taken to obtain a correct development of the bottom. An idea of this phase of chart construction, known as hydrography, is best obtained by following the method of making a simple hydrographic survey as practised by the parties of the United States Coast and Geodetic Survey. Most of the hydrographic work is carried on from small vessels of from 500 tons displacement to a steam launch, and the party will usually comprise from eight to ten officers and forty men on the larger vessels.

When a survey or a re-survey of a certain locality is ordered, the assistant in charge of the party receives such data from the bureau at Washington as will usually enable him, after an inspection of the ground to be covered, to determine upon the system of sounding lines which will cover the work to the best advantage.

A projection of the work is then prepared. This is a sheet showing the meridian and parallels, and is made of heavy drawing paper backed by cotton cloth of a variety not easily distorted by moisture. The projection used in the Coast Survey is that known as the polyconic and is the most accurate representation of the surface of our spheroid on a plane. It is constructed strictly to scale in accordance with the computed values of the projection for the different latitudes. Upon this sheet, bare of all but the meridians and parallels, the triangulation stations of the locality are plotted, as well as any remarkable features of the topography that might serve as signals. The shore line is drawn, and the hydrographic signals, which usually consist of whitewashed tripods from 30 to 40 feet high surmounted by white and black flags, are accurately plotted on the sheet. The sheet is now a chart of the locality showing the shore line and signals, with the water space left blank. It is larger than the finished chart, ranging from 1-5,000 to 1-1,200,000 of the actual size of the earth's surface shown, according to the magnitude or importance of the work.

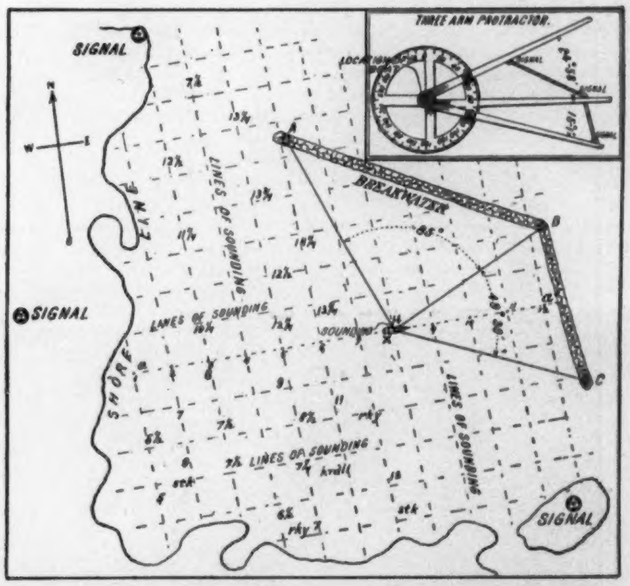
The next step in the survey is to cover the water space of the chart with a system of lines of soundings. A sounding line is run either by a steam launch or the steamer, and in shallow water whale boats are sometimes used. In a launch or small boat the sounding party consists of the two observers, the recorder, the leadsman, and the coxswain. The method of procedure is as follows: The launch is located at the end of the line by the two observers, who simultaneously measure with sextants the two horizontal angles between three signals ashore; these angles, set on a three-armed protractor, and transferred to the chart, give the exact location of the sounding boat at that instant. The principle of this operation is based on the geometrical fact that a circle can be drawn through any three points, and the intersection of the two circles, one drawn through the right and center signals and the launch and the other through the left and center signals and the launch, gives the exact location of the boat. The three-armed protractor furnishes an easy and expeditious mechanical solution of this, the three-point problem. After each fix, the observer who takes the right angle sets the angles on the protractor and plots the position of the boat. The boat sheet or projection is stretched on a board in front of the observer who plots, and by means of the positions, which are taken at intervals of from a minute to four minutes in ordinary work, the officer in charge of the boat is enabled to direct the movements and ke[illegible] lines properly spaced.

The leadsman stands in the bow and sounds with the hand lead, or blue pigeon, getting a cast at each position and at equal time intervals between positions. The recorder, who is by far the busiest man in the boat, watches the clock, gives the time of angling to the observers, and tells the leadsman when to sound. He keeps a record of the time of each sounding and the depth of water obtained, also the time of each position, the angles, and the signals observed upon. He also fills in the column of remarks on the character of the bottom as given by the leadsman, such as hard, sticky, soft, etc., obtained by the feel of the lead as it touches bottom, and makes notes of tide rips and all changes of course or ending of lines, etc. The recorder exceeds the proverbial busy bee by improving each shining second—eyes, ears, voice, and fingers work together; and as the boat speeds along over the surface a record of the time position, and depth, as well as such other data as will assist the draftsman, is entered in the sounding book. The time, aside from its usefulness in spacing the soundings between positions, is a most important factor in the reduction of soundings to the datum plane of mean low water.

To obtain this datum plane and also the state of the tide at each cast of the lead, a tide gage is set up in some sheltered place adjacent to the work. An observer, supplied with a clock frequently compared with those used in the sounding boats, is stationed at the gage and records its readings at regular intervals during the progress of the work. With the tidal data so obtained a reduction is applied to each cast of the lead, reducing it to mean low water.

Soundings on a survey are recorded in feet and quarters of a foot, while the mariner has his lead line marked to fathoms. In accordance with this custom the depths on a finished chart are always marked in fathoms, except on the shaded portions close inshore, where the numbers indicate depths in feet.

A, *B*, and *C* are temporary signals set up for convenience in locating soundings inside of the head water. *X* represents the position of the sounding boat at the eighth set of angles on the line *a a'*. *C*, *X*, *B* is observed by the right-hand observer and is termed the right angle. *B*, *X*, *A* is observed by the left-hand observer and is termed the left angle. A three-armed protractor set to these angles and the edges of arms made to pass through the signals *A*, *B*, *C*, will locate the boat at the center of the instrument. The figures in outline show the three-armed protractor as applied to position 8.



HOW THE CHARTS OF THE COAST AND GEODETIC SURVEY ARE MADE.

On the survey steamers "Bache" and "Blake" employed in the survey of the Atlantic and Gulf coasts, two steam launches and the ship will usually carry on the work of sounding at the same time. The parallel lines of soundings run by one boat crossed at right angles by those of another boat, furnish a valuable check on the work, the steamer being employed in the offshore hydrography. The final plotting of all the reduced soundings on the smooth sheet is the basis of the new or corrected chart.

Thirty miles of sounding lines is considered a good day's work for a steam launch, but the average is less. Currents, tide rip, and rough water often confuse the lines by setting the boat off her course, thus delaying the work.

The charts of the coast are the most important to the navigator, as they mark the danger point of his voyage, namely, the landfall. When this happens in thick or foggy weather, the mariner must in a great measure depend upon the soundings shown on the chart for the necessary information to take him safely into port.

Antwerp, at the end of 1903, still retained the position of being the third largest port in the world, the tonnage of vessels which entered the port being 9,039,313. This figure was only exceeded by London, Hongkong, and New York.

Prizes in France.

The Académie des Sciences has established a number of prizes which are to be awarded during the period from 1905 to 1909. Among the number we may mention the following:

Fourneyron Prize ($200). The Academy establishes the concourse for this prize in 1905 the following question: Theoretical or experimental study of steam turbines.

Hébert Prize ($200). Annual prize designed to reward the author of the best treatise or the most useful discovery for the popularizing and practical use of electricity.

Hughes Prize ($500). Biennial prize founded by the physicist Hughes, designed to be awarded to the author of a discovery or researches which contribute the most to the progress of physics.

Gaston Planté Prize ($600). Biennial prize to be given to the author (French) of an important discovery, an invention or research in the electrical field. The Academy will award this prize in 1905 should there be occasion for doing so.

La Caze Prize ($2,000). This biennial prize will be awarded in 1905 to the author (of any nation) of works or memoirs which shall have contributed the most to the progress of physics. It cannot be divided.

Kastner-Boursault Prize ($400). A three-yearly prize which will be given (if need be) in 1907 to the author of the best work upon the different applications of electricity in the arts, industry, and commerce.

Wilde Prize (one prize of $8,000 or two of $4,000). An annual prize given to the person whose discovery or treatise upon astronomy, physics, chemistry, mineralogy, geology, or experimental mechanics shall have been judged by the Academy as the most worthy of recompense. This work may have been done in the same year, or at another period.

Jean Reynaud Prize ($2,000). An annual prize which will be awarded in 1906 by the Academy to the most meritorious work which is produced during a period of five years. This work is to be original, of a high order, and to have the character of invention or novelty.

Leconte Prize ($10,000). This triennial prize will be given (if need be) in 1907 to the author of a new and capital discovery in mathematics, physics, chemistry, natural history, medical sciences, or to the author of new applications of these sciences which give much superior results over the present.

The close of the concourse for 1905 will take place on June 1 of this year.

Salt Marshes of Congo.

The salt marshes of the Congo region are to be found in considerable number in the district of Sambait, and there are also many of these marshes on the left bank of the river Lufubu. In general they resemble a kind of pocket or rift in the soil. The walls of the rift show first a layer of blackish clay mixed with sand and containing numerous quartz and silex pebbles, or more exceptionally black and white shells, fragments of oyster and mussel. Then comes a layer of stratified and gray-blue schist. The soil of the depression also contains schist as the greater constituent, and is covered by a layer of sandy clay. In order to collect the salt, the natives dig a funnel-shaped hole from 6 to 10 feet in diameter and about 3 feet deep. The cavity soon fills up with a warm and clear water which is strongly charged with salt. It comes up with considerable pressure and the liquid seems to boil. The salt is partly precipitated at the bottom of the cavity and mixes with the soil to form a blackish mud. The latter is washed out with hot water to extract the salt which is then crystallized from the solution. The product which is thus obtained is of a salty gray color. Its taste is more alkaline than that of European salt.

The density of population in the Philippines is 67 per square mile. In continental United States it is 26 per square mile. The inhabitants are usually found on or near the coast, except in the island of Luzon, where about half the people live in the two rich valleys in the interior. Only one-seventh of the civilized population live inland, but the wild peoples are confined almost entirely to the interior. In the archipelago there are 13,400 barrios or villages, with an average population of 500 inhabitants. The average size of the barrio varies widely in different provinces. A number of adjacent barrios form a pueblo or municipal unit, and thus there is practically no rural population. Three-fifths of the population live in villages of less than 1,000 inhabitants and 4 per cent in towns of over 5,000. There are four towns with a population exceeding 10,000 each, and thirty-five with a population exceeding 5,000. Manila is the only incorporated city in the islands, and its inhabitants number 219,928.

HARNESSING THE VICTORIA FALLS FOR ELECTRICAL POWER.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The continent of Africa has been the scene of many colossal engineering achievements, even from the Egyptian era. Within recent years many notable works have been completed in that vast country, notably the Nile irrigation works. Now, however, another ambitious scheme is to be carried out—the harnessing of the Victoria Falls on the Zambesi River, which when completed will constitute one of the greatest engineering monuments of the day.

The Victoria Falls have been described as the eighth wonder of the world, and certainly the cognomen is not misapplied. As is well known, Livingstone was the first white man to see them in 1854, and he narrates the impression they created upon his mind. Long before he reached the falls, the traveler had heard them described in awe by the unsophisticated natives as "Mosi oa Tunya" (the smoke that sounds). That was all the information he could obtain respecting them, and he experienced considerable difficulty himself in adequately describing them, so impressed was he by their colossal magnificence, for they constitute one of the most remarkable phenomena of Nature yet discovered. "The entire falls," wrote Livingstone, "are simply a crack made in a hard basaltic rock from the right to the left bank of the Zambesi."

It is difficult either to describe the peculiar construction of the Victoria Falls or to convey a comprehensive idea of their stupendous proportions, but some estimate can be gleaned from a comparison with the Niagara Falls. The latter measure about three-quarters of a mile in width, with a height varying from 158 feet to 167 feet. In the case of the Victoria Falls, however, the total width of the fall is about a mile, while the height of the falling water varies from 400 to 420 feet.

The course of the Zambesi River in the proximity of the falls is roughly from north to south. About half a mile above the falls the river is 1⅛ miles wide, but it gradually narrows as it approaches the falls, until it is only 1,936 yards in width. At this point there is a yawning chasm, or cañon, into which the river appears to fall to an interminable depth. The fall is nothing more or less than a huge fissure in the level of the river, caused by volcanic agency. This abyss is about 225 feet across. The rock is of a basaltic nature of a dark-brown color. The Zambesi for the whole mile of its breadth thunders down into this narrow gorge, which extends at right angles to the river's course, from shore to shore. The opposite wall of the fissure is as precipitous and as high as that ledge over which the water plunges. In this abyss the water boils and seethes like a gigantic cauldron. It has only one exit, and that is a narrow cleft in the opposite wall, about the center. This opening is only 300 feet in width, and through this contracted doorway the water, after pouring over a ledge a mile wide, is compressed.

The course of the river after it has plunged over the falls is no less extraordinary than the falls itself, for it flows through a narrow gorge only 150 feet in width for a distance of 45 miles. The Niagara gorge extends for only six miles.

The river level in this gorge is 400 feet below the level of the land through which it runs, and the walls of this ravine are precipitous, as may be seen from our illustrations. It is impossible to reach the river from the tableland above owing to the perpendicular nature of the cliffs, except at four places, which are called "doors" by the natives. What the depth of the river water in this gorge is has never yet been ascertained, but it must be considerable, for the river flows comparatively smoothly, only eddying round the projecting rocks.

A curious feature of this river bed is that it does not follow a comparatively straight course, but zigzags in a remarkable manner. For instance, it flows in a straight direction for a few miles, then turns abruptly and flows in a diametrically opposite direction for another few miles, turns again, and so on throughout the 45 miles of its course through the gorge. This channel has only been explored by one white man, Mr. F. W. Sykes, the district commissioner for the falls area, who has secured a splendid selection of photos, many of which we are enabled to reproduce herewith.

Some estimation of the force of the water as it plunges over the ledge may be gathered from the fact that the columns of vapor can be seen, even when the river is at low water, for a distance of five or six miles. In full flood the spray is hurled to such a height that it is visible ten miles away, and the sound of the falling water can be heard from a similar distance.

The idea of harnessing the Victoria Falls for the development of power was first mooted by Prof. George Forbes, the well-known electrical engineer who was largely responsible for the project of harnessing the Niagara Falls, but the first practical steps in that direction were taken simultaneously and independently by the Africa Trust, Ltd., of London, and Mr. H. B. Marshall, of Johannesburg. Upon the suggestion of the late Mr. Cecil Rhodes, who at once grasped the possibilities of the scheme and gave it his warmest approval and support, the two propositions were amalgamated, and took form as the African Concessions Syndicate, Ltd., which syndicate under certain terms and conditions holds the sole concession for developing electrical power at the falls for a period of seventy-five years. Sir Charles Metcalfe and Sir Douglass Fox, who are consulting engineers to the Rhodesia Railways, visited the falls to investigate the possibilities of erecting an electric power installation.

Since then they have been visiting this country and inspecting the installations at Niagara and Oakland, California, preliminary to a minute survey of the Victoria Falls and the planning of a gigantic power plant.

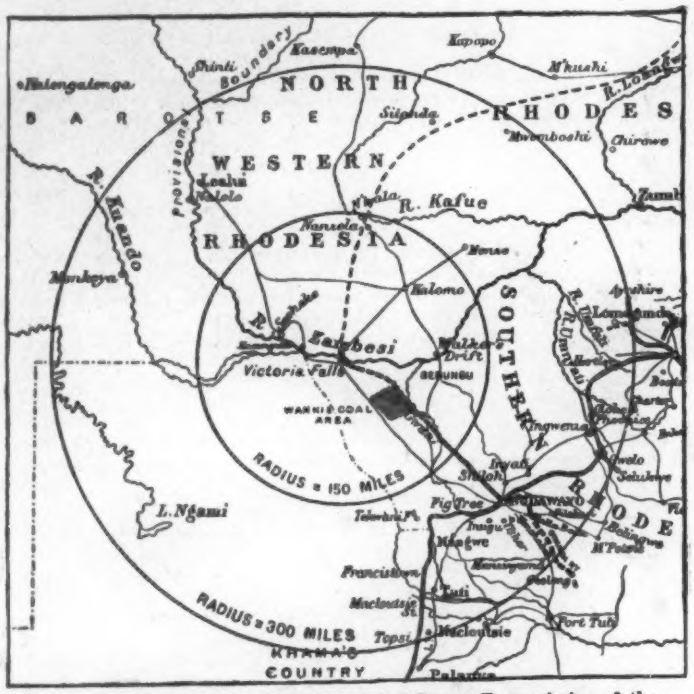
The power which it is possible to obtain from these falls is enormous. In the case of the Niagara Falls, it is computed there is 7,000,000 horse-power running to waste, while at the Victoria Falls, it is estimated that when the Zambesi River is in flood, discharging double the volume of water of that at Niagara over the gorge, there is about 35,000,000 horse-power running to waste.

During the dry season this is much reduced; but, even in the driest years, the volume passing over the lip is very large, so that several million horse-power will always be available.

The initial survey of the falls for the purposes of the power scheme is now in progress, and this part of the work alone will cost some $50,000. Details of the installation are now only in preparation and will take several months to complete. The broad principle, however, is to place the power house on a benching in the second zigzag below the cascade of the Zambesi and to draw the water by steel tubes from the falls. Any amount of power required can be obtained, and an available head of at least 250 feet could be utilized. Each pipe or tube will be 8 feet in diameter, and will drive a turbine and generator necessary for 5,000 horse-power, and it will probably be found desirable to lay down the plant in units of this magnitude. The ultimate size of the power house will be determined by the demand for electricity in the neighborhood. The question of voltage will depend to a very large extent upon climatic conditions, and also upon the output and the distance to which power would have to be transmitted. At high voltages the air ceases to be a good insulator, and when moisture is present sparking into the atmosphere takes place, and a large amount of electricity passes through the air from one wire to another. Special transformers and insulators will be designed for much higher voltages than are now adopted. At present the limit is that at which an uncovered copper conductor will retain the current.

It is estimated that the first outlay will represent some $2,500,000. This will only suffice to erect a section of the plant. It is projected to distribute the power over a radius of 300 miles from the power station. In this area is situated the township of Buluwayo, the street railroads and lighting of which it is projected to operate by this electrical power.

The realization of this scheme will exercise a far-reaching influence upon the commercial, industrial, and mining developments of the country. In this region are located the extensive Wankie coal fields, wherein coal seams as much as 37 feet thick and near the surface are to be found. These and the numerous gold, copper and other mineral fields, will be worked by electricity very cheaply and profitably, as the charge for the power generated by the falls will be very low. What is far more important is that several reefs containing only a small percentage of mineral ore, which cannot be rendered by the existing methods financially remunerative, will by this agency be operated at a profit. It is also anticipated that the railroads will be driven by the same power, especially the local lines, as it will be found much cheaper to maintain electrically-propelled trains than steam locomotives and carriages. The possibilities, therefore, of electrical power generated by the Victoria Falls are innumerable.



Three Hundred Miles Radius of Electrical Power Transmission of the Victoria Falls Power Station.

The Zambesi Railroad Bridge As It Will Appear When Completed.

HARNESSING THE VICTORIA FALLS FOR ELECTRIC POWER.

A New Automatic Machine Rifle.

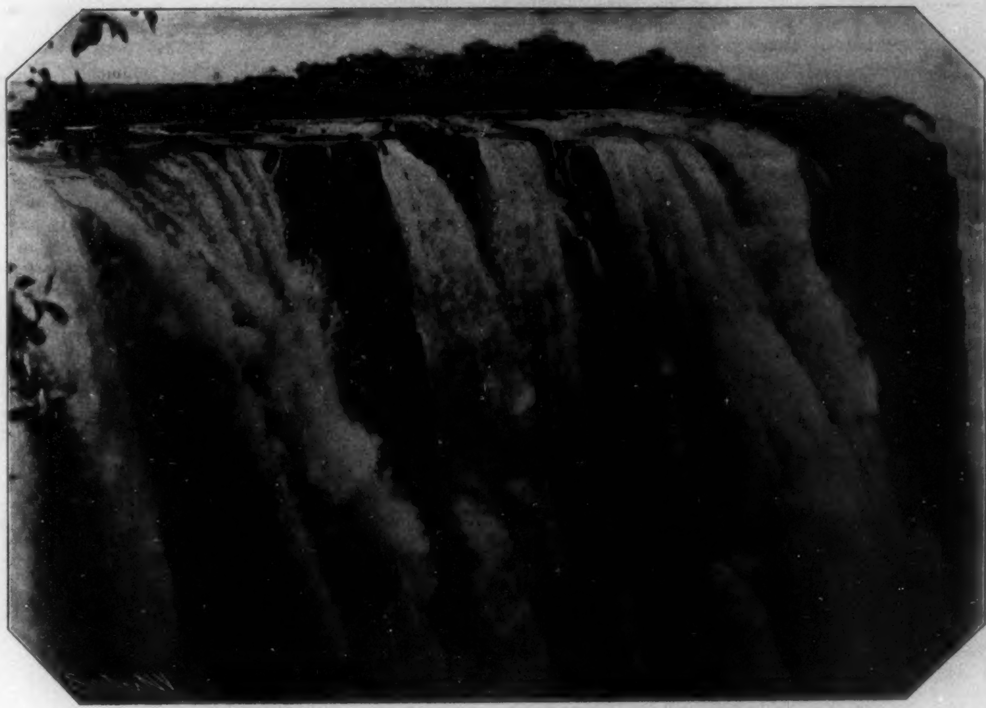
Some highly interesting trials have been carried out before several officers of the British army with the new Rexer machine rifle. A great future may await this weapon if it practically solves the great difficulty heretofore experienced in the use of machine guns firing small arm ammunition, i. e., the necessity of some description of wheeled transport. In general appearance the Rexer automatic machine gun resembles the ordinary rifle except that it has a perforated casing surrounding the barrel. It weighs only 17½ pounds and is carried and used by one man. When in action, unless at exceedingly close ranges, it is impossible to distinguish between a Rexer gunner and an infantry soldier using the ordinary infantry weapon.

The numerous advantages of this weapon comprise lightness and portability, rapidity of fire, ease and quickness with which it can be brought into action and the small target which it affords to the enemy. The gun can be instantaneously adapted for either deliberate or automatic firing. The maximum speed of

firing is about fifteen rounds per second, and the changing of the clips, each of which holds twenty-five rounds, occupies only about the same space of time. The gun consists of a barrel and inclosed casing containing the mechanism and a stock. The barrel is surrounded by an outer tube, in which it travels backward and forward, being driven back by the recoil, and forced forward into the firing position again by the action of a spring. During the recoil and the return, the ejection of the spent cartridge and the insertion of the new in the chamber is effected automatically by the mechanism. Toward the muzzle end of the outer casing of the barrel are two light legs, forming a support, on which the gun can be readily trained in any direction. A very important and valuable feature of the weapon is the dispensing of a water jacket for the cooling of the barrel. Notwithstanding the rapidity or duration of firing, the barrel keeps quite cool. In operation, the soldier lies on the ground in the ordinary firing position. In transport, the gun and 250 rounds of ammunition are easily carried by one man; or it can be carried on horseback in a bucket, in the same manner as a carbine, together with 500 rounds, which are placed in handy magazines strapped to the saddle.

The arm has been adopted with conspicuous success in the Danish army, and experienced soldiers can maintain a fire of 300 rounds a minute. According to official tests, its accuracy is also a prominent characteristic, the percentage of hits being approximate to that of ordinary rifle fire at ranges varying from 300 to 500 meters.

The first passenger car ever constructed for a street railway was used in New York city in the third decade of the last century. This car was drawn by horses over strap rails laid on stone ties. Improvements introduced during the next forty years were principally in details, but the introduction of the cable system in 1873 was a decided advance in motive power. At the present time, however, the use of the cable car is confined almost exclusively to Chicago, San Francisco, and Kansas City, while the trolley, which was not used to any great extent prior to 1885, has practically superseded all other systems. In several instances even the steam railways have introduced electric motive power. In view of the movement to abolish overhead wires in the large cities, the success of the open conduit system, which has been introduced in the more populous parts of New York and Washington, is worthy of note. In 1902 the number of miles operated by this system in these cities was 264.

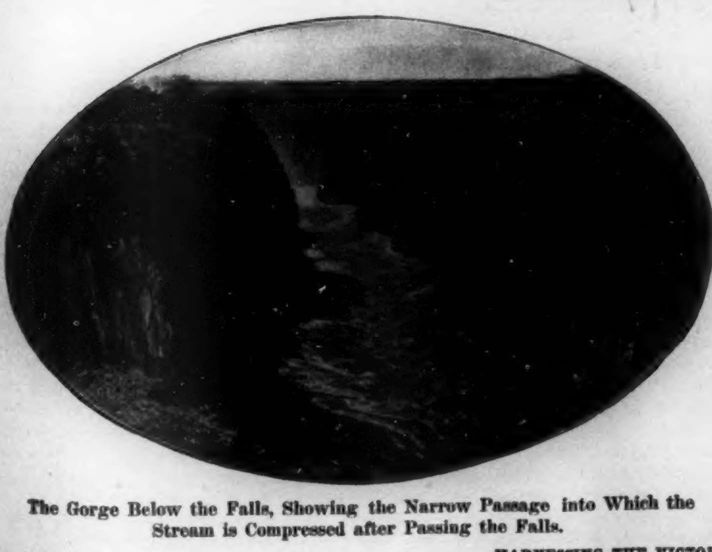


Part of the Central Fall.

A View of the Falls at Low Water.

The Gorge Below the Falls, Showing the Tortuous Formation of the Channel After the Stream has Leaped the Falls.

The Eastern End of the Falls at Low Water.



The Gorge Below the Falls, Showing the Narrow Passage into Which the Stream is Compressed after Passing the Falls.

The Leaping Waters, or Western Cataract.

HARNESSING THE VICTORIA FALLS FOR ELECTRIC POWER.

POMPEIIAN SILVER WARE.

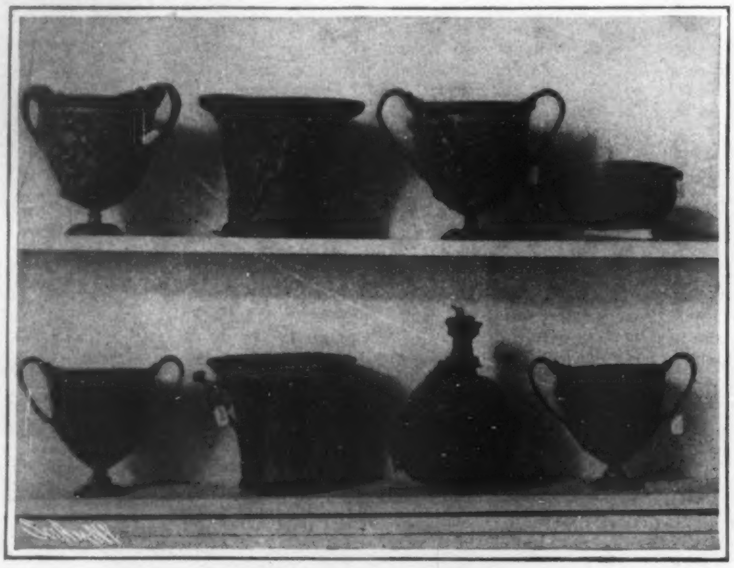
BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The Naples Museum contains a number of very handsome silver pieces which come from Pompeii and Herculaneum. Some of the most remarkable of these are illustrated here. Conspicuous among them is a large vessel of bucket form with a movable handle. It is decorated with a relief design representing the interior of the Baths, with four female figures in different attitudes. On either side is an incense burner, consisting of a richly-ornamented silver vessel, of cup form, supported upon a four-footed bronze support. The latter is, however, of modern workmanship and is intended to replace the ancient tripod, which is missing. These two pieces are practically alike. The cups show a high order of design, and are ornamented with festoons and foliage, set with small garnets. Among the most remarkable specimens of silver found at Pompeii are four vases of two-handled calice form which are shown here. They were known as *scyphæ*. These cups are decorated with bas-reliefs representing centaurs and bacchic symbols. A double bottom or lining is provided in the interior of the cup, in order to prevent the sediment of the liquid from depositing in the cavities of the reliefs. Under the base of one of the vases is engraved the name SOSINI LAPII. These specimens measure 5 inches high and somewhat less in diameter.

Between the two above-mentioned vases on the top row will be observed a fine specimen in the shape of a mortar, decorated with a well-executed relief design representing the Apotheosis of Homer. Here we have the great poet, with the head partly veiled, clothed in the *vestis talaris*, and seated upon an eagle which is bearing him to the celestial regions. On one side (which is visible here) we see a warrior with his head resting upon the right hand and holding a sword and a steering oar, representing the Odyssey. The pendant on the other side represents the Iliad by a similar figure armed with the sword and lance.

Another specimen in the form of a mortar, lying just below the former, is ornamented with a relief representing a combat between Theseus and an Amazon. In the upper row is a shallow cup with a well-executed design representing Minerva mounted upon a chariot drawn by two horses. The owl, which is consecrated to the goddess, is sitting in front of the chariot upon a wand or lance. The remaining figure in this group is a censer or perfume-burner, which carries a perforated cover and a chain for swinging it. The interior is entirely preserved from oxidation.

The circular plate which is observed in the middle of the second engraving is used to form the back of a mirror. The design represents a female figure seated, with the head thrown back. She is sustained by a second draped person in the rear. Another female figure and a Cupid are placed in front of the group. The composition is said to represent the death of Cleopatra. Two intertwined serpents form the handle of the mirror. On either side of this specimen are two plaques in high relief representing Apollo and Artemis. The figure of Apollo is especially well preserved. The three specimens below are cups of different forms ornamented with leaf designs.



Scyphae or Vases and Cups.

Plaques and Vessels.

Bucket and Incense Burners.

ANTIQUE SILVER WARE FROM POMPEII AND HERCULANEUM.

A New Bone-Treating Process.

Various patents have recently been issued to Joseph R. Hunter, for processes for the treatment of bone and methods for utilizing the products of these processes.

Patent No. 781,883 covers a process of treating bone. In this process the bone is freed from mineral matters, particularly phosphate of calcium. Preferably, fatty matter and moisture are also removed. This may be done preliminarily or at the same time as the removal of the mineral matter. The bone is washed and cut up for convenience in handling, and to make all parts easily accessible to the treatment. It is then placed in a vessel containing an acid in solution, which will combine with the calcium to form compounds soluble in water.

The percentage of acid to be used is preferably relatively small, but varies slightly according to the acid, the character of the bone, whether fresh or dead, and the temperature at which the process is carried out. The most suitable temperature in the case of hydrochloric acid is in the vicinity of blood-heat. The fiber remaining from the acid treatment, ordinarily termed "ossein," is then washed thoroughly and the acid removed by churning or working in the water or in a solution of sal-soda. Any objectionable color of the fiber may be removed by bleaching with peroxid of hydrogen. The ossein is preferably kept wet until the process is complete, but may be moistened if it dry too much. From the soda-washing or from the bleaching process the bone is put into a beating-engine and thoroughly beaten. This breaks the fiber up somewhat, but the division is preferably completed in a refining or Jordan engine to the fineness required for the desired purpose.

Patent No. 781,881 covers a filler for rubber, the object of which is to reduce the weight of the product, the filler at the same time being non-inflammable, a non-conductor of electricity and heat, impervious to moisture, and little affected by ordinary acids. The rubber is combined with finely-divided bone or "ossein" in the form of fibers, produced by the process above described.

Patent No. 781,884 covers a product from ossein. The bone is treated as described in the Letters Patent No. 781,883. The ossein has a tendency to shrink or collapse transversely of the length of the cells. The ossein is compressed while in this condition—that is, before the walls of the cells have returned to their condition of rigidity—to collapse the cells, elongating at least one axis thereof, and the cellular structure "sets" in the compressed position. The ossein is most advantageously compressed for various purposes into sheets or blocks.

Patent No. 781,880 covers a product from bone. The bone is treated as described above. The fibers after leaving the refining engine are pliable and soft and have a ragged body caused by the projection of small filaments or particles therefrom as in the case of wool. This product may be felted or woven to advantage. This material is a non-conductor of heat and of electricity, is impervious to moisture and substantially fireproof.

Patent No. 781,882 covers a compressed product from bone. This is similar to the patent No. 781,880, just mentioned, the difference being that the fibers are compressed into blocks or sheets without the use of an agglutinant.

The 5,000-Kilowatt Steam Turbines for the St. Denis Power Plant.

In a power plant in course of construction at St. Denis, four steam turbines of 5,000 kilowatts each are being installed by Messrs. Brown, Boveri & Co. Each turbine, which can give up to 6,000 kilowatts, turns at 750 R. P. M. and is worked at the inlet valve under an excess pressure of 12 atmospheres and 360 deg. C. maximum superheat. In the condenser the vacuum should not fall below 90 per cent. Provided the turbine works under these conditions, the consumption of steam is not to exceed 6.8 kilogrammes per kilowatt-hour. This figure has, however, been chosen rather high, and it is thought quite certain that tests on delivery will give far better results.

Each turbine has been fitted with a surface condenser, the air and circulation pumps of which are operated by a direct-current motor, and is direct-coupled with a 5,000-kilowatt generator, supplying alternating current at 10,500 volts with 25 cycles. Each such set is provided with a steam-operated oil pump, supplying oil to the various parts of the set.

The four turbo-alternators are excited by a 300-kilowatt direct-current turbo-dynamo rotating at 2,700 R. P. M., which is likewise fitted with a surface condenser. The tension is 200 volts. In addition there are two motor generators of 375 kilowatts each to be installed, to supply part of the excitation current.

There is further provided a battery of Tudor accumulators of 1,300 ampere-hours, to operate the steam-boiler feeding pumps and to supply the exciting current in case the plant, after having been out of service, is to be operated again.

For motor-car power transmission, a roller chain greased with suet gives 94 per cent efficiency.

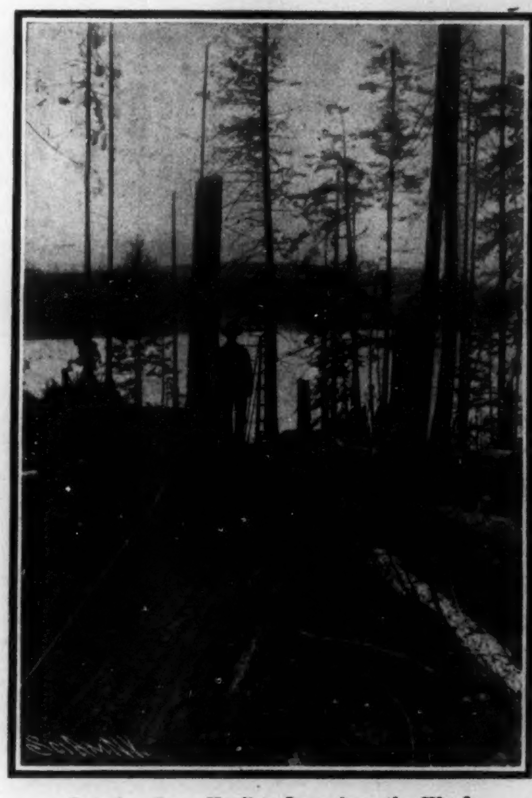
NOVEL METHOD OF LOGGING SMALL TRACTS.

BY JAMES G. M'CURDY.

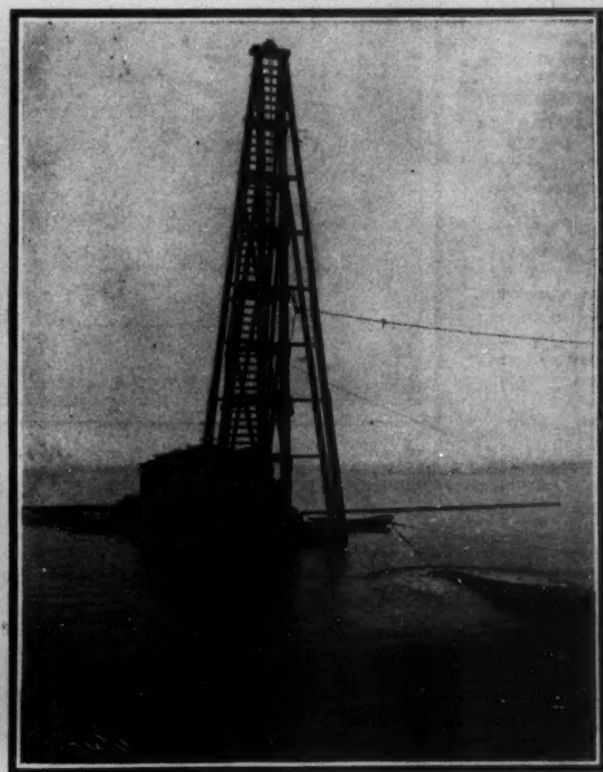
Along the shores of Puget Sound and contiguous waters are numerous small tracts of timber. Many of these tracts lie in favorable localities, and are covered with a heavy growth of fir or cedar. But being scattered they cannot be worked in conjunction, and taken singly are not of sufficient area to warrant the installing of a logging outfit of the usual type.

Opening a logging camp is costly, and much of the preliminary work is dead expense; while the method of procedure with its attendant outlay is almost identical, whether the claim so opened is extensive or restricted in extent.

Recently F. J. Bailey, a practical wharf-builder and logger, conceived the idea of logging small tracts of timber lying adjacent to tidewater, by means of a powerful engine placed upon a scow. So economical and practical did the method prove that others have followed his example, and the unique plan seems destined to become extensively used as soon as its merits are more widely known. At various points in the Puget Sound region loggers are using these floating outfits, and many timber claims heretofore considered comparatively valueless are now in demand.



Logging Scow Hauling Logs from the Woods.



The Logging Scow.

In adopting this method, the first step is the construction of a staunch, roomy scow, some 20 feet in width by 60 feet in length. A house is built over the greater portion of the scow, and this furnishes quarters for the working crew, and protects the engine, drums, and other logging apparatus. The forward end of the scow is built like a pile-driver, with a superstructure more or less lofty, fitted with a sliding hammer. Beneath the deck, in the body of the scow, are several tanks, which are large enough to contain a supply of water sufficient for two weeks' running.

The advantages of the floating outfit can be readily understood. To begin with, the trouble and expense of transportation are reduced to a minimum, as the scow can be readily taken in tow by a small tugboat, or can even be warped along the shore with anchors and cables, for considerable distances. Weeks are spent by the usual logging outfits in clearing a place for buildings, erecting the quarters, making landings, putting in skid-roads, and setting up the engine. By using the scow, much of this time and expense is done away with. Three or four piles driven close inshore for the scow to lie against constitutes a landing, and no additional quarters for the crew need be constructed. The only road built is a rough trail, with brush and logs swamped out. No skid-oil is used, which in itself is no small saving, as the oil bill of a camp with a two-mile haul amounts to fully $1,000 per annum. After the trees have been felled and sawn into desired lengths, a short wire rope called the "choker" is fastened about the end of a log, and to this is hooked a ⅞-inch wire rope, known as the "main line." A long cord running from the engine whistle back into the timber affords speedy communication between the scow and shore.

At a given signal the engineer starts the machinery, and the main line is reeled in by a revolving drum, drawing the log down the trail and out of the woods at a lively rate.

Where a logging engine is set up on shore, the logs have to be dumped upon the beach in a confused pile, and in consequence the landing soon becomes congested. Sometimes it takes days of hard labor to clear the landing and get the logs afloat. With the logging scow, the logs can be drawn from the woods into deep water, without additional handling, and be pike-poled into an inclosure constructed of boom-sticks, where they can be held secure against the action of wind and tide.

To return the end of the main-line to the woods, after a log has been hauled out, a smaller wire rope, known as the "haulback," is used. The haulback is connected with the shore end of the main line, and is rove through a block securely fastened to a tree, at the far end of the trail. Thence it returns to the scow, being held out of the way by little blocks fastened to trees, and is reeled upon an auxiliary drum, the whole forming a continuous circuit. As one line is drawn in the other is reeled out, and *vice versa*, by the action of the two drums.

The engine is powerful enough to pull the largest logs that are to be met with, and can easily draw two or three medium-sized logs linked one behind the other. Where the logs lie at a distance on either side of the central trail, by the use of short ropes and blocks skilfully placed at various points, they can be hauled into any position desired. It is extremely interesting to watch the huge, unwieldy logs being drawn here and there, and handled with ease by a motive power located at a distance of half a mile or more from the scene of operations.

With one engine logs can be drawn a distance of about three quarters of a mile, and those operating with scows do not as a rule attempt to log beyond this distance. But by using one or more auxiliary engines in the woods, the sphere of operations could be extended indefinitely.

A strip about 900 feet in width can be logged without moving the scow. When such a strip has been cleared, the scow is warped along the beach to a new anchorage, another section of timber is opened, and so on until the claim has been gone over thoroughly. Then the logs are made into booms and sent to the mills, when the outfit can be towed to new fields.

While the first cost of such an outfit as has been described is more than a small outfit of the usual type, the difference can be more than made up the first year, under ordinary circumstances, from the savings on oil, landings, and roads. As previously stated, the plan is primarily for short hauls, and would not present so many advantages where a long haul is necessary to get the timber into the water.

The accompanying photographs of the outfit owned by F. J. Bailey represent a special type of pile-driver and logging scow combined, the lofty "jins" being par-

Pulling the Logs from the Beach.

Hauling the Logs into the Central Trail.

NOVEL METHOD OF LOGGING SMALL TRACTS.

ticularly prominent. During dull seasons in logging, this form of scow can be used in general wharf construction and repair work without any alterations whatever, which makes it an especially advantageous type. Two of the views show the scow salvaging logs, a work in which it is frequently engaged. Towing logs in northwestern waters is precarious work, and during the year many tugs, while *en route* to the mills, are caught in sudden storms and lose their tows, which eventually find lodgment on some exposed shore.

Saving these logs is a difficult task. They soon become imbedded in the sand, and hard as it is to get them afloat, it is still harder to prevent their being carried away by the swift current or washed upon the beach again, before they have been re-boomed. The logging-scow method has been the most successful thus far tried for salvaging logs lost in transit, as it possesses sufficient power to draw the logs from the beach, and facilities for securing them when afloat.

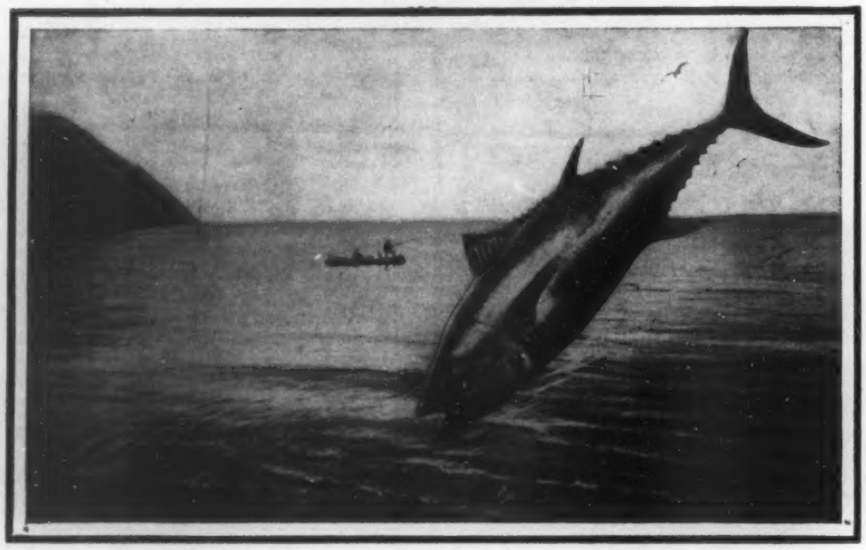
PHOTOGRAPHING LEAPING FISHES.

BY CHARLES F. HOLDER.

A number of years ago I began to experiment with the camera to obtain photographs of leaping fishes, but always with indifferent success. The most difficult game appeared to be the large California flying fish, *Exocetus californiensis*, which from the middle of May is a feature of the Santa Catalina channel, appearing in large schools and remaining all summer to deposit spawn in the bays of the islands. I made my first attempt from the bow of a steamer. I secured a position at the porthole in the bow, and while it was impossible to aim the kodak with any certainty I snapped it at a number of fishes, hoping accidentally to take them; but the plates invariably developed blank; the flying fish had passed out of the field before I pressed the button.

Later I made the attempt from a small launch, with more or less amusing results. I sat on an elevated deck, so that I could command the field, and held a large kodak ready for the fray. The first flying fish came directly toward the boat, passing within a short distance of me—in fact, so near that I moved to avoid it. Another flier struck the boat; and on another occasion a fish almost unbalanced me, striking my neck; but this was at dusk. In none of these attempts was I successful, for it requires some skill to face a heavy flying fish, coming like a shot, with a camera and to dodge it at the right time. I had equally unsatisfactory results in attempting to photograph the tuna.

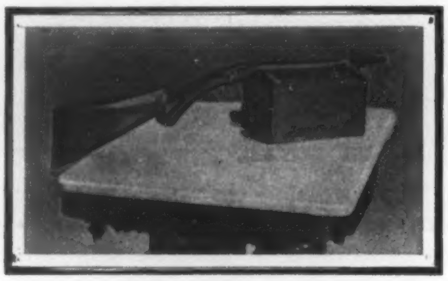
In my attempts to photograph the tarpon I was also unsuccessful. I forced the fish to leap so close to the boat that they appeared to be coming aboard; but the sight was always so wonderful, that though I held the kodak between my knees and had formulated an elaborate plan to pass my rod to the boatman on the jump and use the kodak, it was always a failure. When the splendid fish rose into the air I forgot the camera until too late. These more or less humorous adventures have probably befallen others who, not being expert photographers, will welcome a device which experiment has demonstrated, renders it an easy matter to photograph fishes of all kinds or indeed any animal in the air. It is literally a gun camera, devised by an ardent tarpon angler, Dr. W. H. Howe, of the city of Mexico. Dr. Howe spends a part of each winter at Tampico, where the tarpon appears to winter, and as the fishes are high jumpers and were in smooth water near shore he began to experiment along various lines, resulting in a gun camera which solved the question. The splendid tarpon, the "silver king," was caught in the very act and shown in various positions in the air, making a valuable addition to the angler's store and explaining many hitherto little understood features of tarpon leaping. The appliance of Dr. Howe is made up of a gun stock and a 4 x 5 kodak, the latter being fitted into the stock so that the shutter and opening will be on a line with the sight. The shutter is connected with the trigger by a line, or wire, and to all intents and purposes the affair is a gun and used as such from the shoulder.



An Example of False Photography, Showing the Leaping of the Tuna.

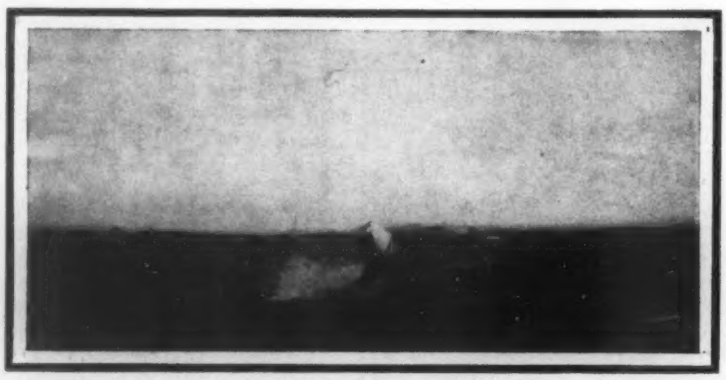
Two pictures were used to produce this. The picture of the fish was pasted on the fishing scene and the whole re-photographed.

The pictures were taken in the angler's boat, or from a second boat, the fisherman shouting a warning at the strike, whereupon the man with the gun camera rose, held it in the position of ready, and as the tarpon cleared the water in its initial leap raised it to the shoulder, aimed, and pulled the trigger or shutter. Dr. Howe's films show how excellent are the results, the tarpon being seen in every phase of leaping. With this appliance the flying fishes and tuna could be taken with comparative ease, while for birds on the wing the appliance would appear to have many advantages. The attempts to secure animals in action, especially the difficult feat of taking fishes, have resulted in a variety of pictures not inappropriately called "false photography," in that no deception is intended, an explanation being given. This is illustrated in the accompanying photograph of a tuna. The picture is as perfect as though the fish had been caught in the beautiful leap which has made the tuna famous; but the picture is merely the clever manipulation of the photographer, and when explained and understood by the reader becomes a rational and legitimate method of illustrating. In this instance the photographer took a large plate view of a section near Avalon Bay, noted as a scene of the tuna's leaps. Then a fish was posed and photographed, this being cut out of the photograph and pasted upon the proper background by an expert who had observed hundreds of leaping tunas; then the result was photo-engraved, giving a picture of a leaping fish which would be considered from nature by two-thirds of those who saw it. The picture, so far as position, height, etc., is concerned, may be said to be as natural as life, and indeed, was not modeled from memory, but from a real photograph of a tuna taken a long distance away, yet showing the exact position.



The Photographic Gun.

The gun camera will provide a valuable field for sportsmen and naturalists. The leap of the salmon, that of the mullet, the stupendous jumps of the whip ray, which I have observed clear remarkable distances in the Aransas region of Texas, the erratic jumping of the ten-pounder, will afford interesting subjects. The camera has entered many fields, but there are scores of forms which have yet to be taken in action. The many soaring animals, as the so-called flying lizard or draco, could be easily caught with this gun, as well as the flying squirrel in its downward rush. The bat has never been shown upon the wing, and at twilight could possibly be caught; indeed, this interesting plaything opens a new field.



Tarpon Just Emerging for a Leap.

A Leaping Tarpon Caught by the Gun Camera.

PHOTOGRAPHING LEAPING FISHES.

Trials of Submersible and Submarine Boats.

The French Admiralty have recently carried out, at the harbor of Cherbourg, a series of interesting experiments to test the comparative value of submersible and submarine boats. The results of these trials have incontestably demonstrated the superiority of the former type of craft. The direct objects of these relative trials have been the investigation of the question of navigation on the surface and the habitability of the vessels. The time occupied by the submersible vessel "Aigrette" for the passage from surface to submarine navigation thoroughly satisfied the commission, but the submarine "Z" was found to be much inferior. The "Aigrette" is an excellent vessel; the "Z" is badly designed.

There is a kind of coffin-box fixed on the prow containing the four torpedo tubes which, with the mechanism, make a weight of at least two tons and so burden the vessel that it dips into and plows the wave, thus losing speed. The commission has therefore decided to abandon type "Z," while the work on three units, the "Emeraude," "Rubis," and "Topaze," already begun at Cherbourg, will now probably be stopped. This decision, however, does not imply that the submarine boat is to be abandoned in favor of the submersible, since the commission is convinced that the submarine ought to be exclusively used for defensive, and the submersible for offensive tactics. It is proposed to increase the tonnage of the submersibles to approximately 400 tons, and to decrease that of the submarines to 100 tons.

RECENTLY PATENTED INVENTIONS.

Electrical Devices.

ELECTRICAL STOP-MOTION.—G. B. Cocker, Frankford, Pa. The invention pertains to cordage machinery; and its object is the provision of an electrical stop-motion for twisters, warpers, winders, spoolers, and similar cordage machines, the stop-motion being arranged to stop the machine, as soon as one of the yarns or threads breaks, without the use of drop-wires or the like—such, for instance, as are shown and described in a patent, No. 512,013.

Of Interest to Farmers.

FRUIT-PICKER.—F. Fisher, Jr., Oconto, Wis. Mr. Fisher's object is the provision of an improved fruit-picker, easily manipulated by the operator standing on the ground, and arranged to permit of picking the fruit and delivering it to a pocket within convenient reach of the operator without danger of bruising or otherwise injuring the fruit or tree. As soon as the fruit reaches the pocket and has come to a rest therein it can be readily removed by the operator and placed in a basket or other suitable receptacle standing on the ground or carried by the operator. Means are provided for shortening the picking device when desired.

Of General Interest.

DETONATING FIRE-ALARM.—M. A. Libbey, South Berwick, Me. The principal object of the invention is to provide an alarm device operating by detonation to give notice of the occurrence of fire in an apartment, room, or other place, and also to provide a device of this character which is exceedingly simple, and inexpensive to manufacture. On the melting of a binder or solder a striking member of the device is released, whereupon said member of its own resiliency or tension is carried into forcible contact with the fulminate in the holder, thereby exploding the fulminate. The device may be readily secured to any part of a ceiling or wall of a room or apartment or to any object or support within the room.

LATCHING DEVICE FOR SAFETY EXIT-DOORS.—G. E. Redden, New York, N. Y. This device is of peculiar value in theaters and other auditoriums in which it may be necessary—as, for instance, in case of fire or of a panic—for people to readily escape from the building. The first person to run against this improved door or even to touch it gently with the finger causes it to open. In case of a blind rush of people or of the movements of a single individual the door swings open.

UMBRELLA.—G. Turner, Tacoma, Wash. According to this invention the umbrella is so constructed that upon removing a member from the umbrella-stick the umbrella will be rendered useless to any one excepting the rightful owner, who has a means for restoring the article to its useful condition.

Heating and Lighting.

WATER-HEATER WITH GARBAGE-BURNER.—M. E. Herbert, Chicago, Ill. Mr. Herbert's invention is in the nature of a form of furnace designed more particularly for a water-heater, and so constructed as to permit of economical disposition and utilization of garbage in connection with other fuel. By combination and arrangement of parts either garbage or soft coal may be burned on this supplementary grate with a complete combustion and without production of bad odors, securing at the same time an economical and efficient water-heater.

Machines and Mechanical Devices.

SAFETY DEVICE FOR ELEVATORS.—F. B. Austin, Tombstone, Arizona. The aim of this improvement is the provision of a safety device for elevators, more especially designed for use on mining-shafts, to prevent the cage from being drawn up too far on overwinding the hoisting-cable on the winding-up drum, to prevent the hoisting-table from breaking, and the cage and its occupants from dropping down the mine-shaft.

TALKING-MACHINE.—J. E. Beatty, Huntingdon, Pa. This improvement is in the nature of an attachment for use on talking-machines, especially relating to the employment of a violin as a sound-box or reproducer by turning such instrument upside down and employing a special form of bridge carrying the needle or stylus which operates in the record.

Pertaining to Vehicles.

YIELDING SPRING-WHEEL.—L. Marchand, 28 Rue du Fresnoy, Roubaix, department du Nord, France. Mr. Marchand's invention pertains to a wheel having yielding curved spokes. In this wheel each of the yielding spokes is joined at one of its ends on the hub, while its opposite end is movable and guided with respect to the tire in a radial direction. This arrangement prevents the spoke from giving way alternately in two contrary directions, which often causes the breaking up of the wheels having yielding spokes as constructed heretofore.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 6761.—For manufacturers or parties selling a traction gear on which a 5 to 8 h. p. gasoline engine can be mounted.

For hoisting engines. J. S. Mundy, Newark, N. J.

Inquiry No. 6762.—Wanted, the address of The Dalt Electric Light Co.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 6763.—For firms' names installing crude oil gas plants.

Perforated Metals, Harrington & King Perforating Co., Chicago.

Inquiry No. 6764.—Wanted, address of makers of very strong glass known as agatine.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 6765.—For manufacturers of plucking machines (fowl).

Adding, multiplying and dividing machine, all in one. Felt & Tarrant Mfg. Co., Chicago.

Inquiry No. 6766.—For manufacturers of machinery for turning out spoon oars and paddles.

Commercially pure nickel tube, manufactured by The Standard Welding Co., Cleveland, O.

Inquiry No. 6767.—For manufacturers of jugs.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 6768.—Wanted, the address of parties making "Opal Glass," "Nickeloid" and "Nickolene," which are used to line refrigerators.

I sell patents. To buy them on anything, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

Inquiry No. 6769.—Wanted, the address of the Porter-Allen engine manufacturers.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Machine Company. Foot of East 138th Street, New York.

Inquiry No. 6770.—Wanted, the address of the manufacturer of "Yankee" safety razor.

Gut strings for Lawn Tennis, Musical Instruments, and other purposes made by P. F. Turner, 46th Street and Packers Avenue, Chicago, Ill.

Inquiry No. 6771.—Wanted, address of manufacturer of endless duck aprons and ribbons.

We manufacture iron and steel forgings, from twenty pounds to twenty-five tons. Crank shafts of all varieties. Erie Forge Company, Erie, Pa.

Inquiry No. 6772.—Wanted, address of firms making machines for tying bundles of shook with wire.

We Manufacture on Contract anything in light Hardware. Write us for estimates. Edmonds-Metzel Mfg. Co., 143-153 South Jefferson Street, Chicago.

Inquiry No. 6773.—For manufacturers of beer trap water gates and water gates in general.

Wanted.—An engineer experienced in the design, construction and use of gasoline motors for automobiles. Address J. F., Box 773, New York.

Inquiry No. 6774.—For manufacturers of porcelain-lined cylinders such as are used in connection with wooden pumps; also castings used in buckets for same.

The Scientific American Supplement is publishing a practical series of illustrated articles on experimental electro-chemistry by N. Monroe Hopkins.

Inquiry No. 6775.—For manufacturers of dust protectors for the nose.

Sheet metal, any kind, cut, formed any shape. Die-making, wire forming, embossing, lettering, stamping, punching. Metal Stamping Co., Niagara Falls, N. Y.

Inquiry No. 6776.—For manufacturers of corrugated or other form of ties used in tying brick veneer to storm sheeting.

General Utilities Company, 299 Broadway, New York, offers unusual facilities for placing inventions and devices of merit before the public. Correspondence invited.

Inquiry No. 6777.—For manufacturers of gasoline or internal combustion motor cars suitable for interurban railway service.

Wanted.—Colonial silverware. Any one wishing to sell any authentic silver made in this country during the eighteenth century, please communicate with C. A. M., Box 773, New York.

Inquiry No. 6778.—For manufacturers of oil cans 4 x 18 with patent air hole spout, seam; must not be costly nor hold more than a gallon.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 6779.—For manufacturers of gins for ginning moss and other similar fabrics.

You can rent a well equipped private laboratory by day, week or month from Electrical Testing Laboratories. 548 East 80th Street, New York. Absolute privacy. Ask for terms and facilities.

Inquiry No. 6780.—For manufacturers of machines for wiring and sealing small wooden boxes about 18 inches square.

Space with power, heat, light and machinery, if desired, in a large New England manufacturing concern, having more room than is necessary for their business. Address Box No. 407, Providence, R. I.

Inquiry No. 6781.—For manufacturers of Baldwin's luminous paint.

Wanted.—Bids on plant capable of turning out 100 gross of special pencils per day. For specifications and full particulars address Continental Manufacturing Co., 1155 Broadway, Oakland, Cal., Suite 28.

Inquiry No. 6782.—For parties manufacturing or controlling patents on crude oil burners; such as might be used for hot water, steam and hot air house-heating.

Wanted.—Representative to sell our spinning, weaving and batting machinery, by oldest firm in France and Germany. Grand prize awarded Paris Exposition. Address Steeg, 563 William Street, Buffalo.

Inquiry No. 6783.—For manufacturers of liquid fuel burner for baking oven; also information concerning the same.

Wanted.—Superintendent for well established wagon plant in East. Must have experience and capabilities to handle large and modern factory. Address
Tapping & Riedeburg, Milwaukee, Wis.

Business and Personal Wants.

(CONTINUED.)

Inquiry No. 6784.—For manufacturers of cardboard.

Splendid opening for a high-grade mechanical engineer, who has had a broad experience in managing machine shops, the manufacture of machinery, engines and metal specialties. Applicants must be in prime of life and now employed. Preference will be given to applicants who have had modern scientific training in mechanical schools of high standing. Unqualified references will be exacted. All communications received will be regarded as strictly confidential. Address Mechanical Engineer, Box 773, New York.

Inquiry No. 6785.—For manufacturers of small engines of 1 to 3 h. p.

Factory located in Mississippi River town, now manufacturing a line sold to the hardware trade, is desirous of adding to their line, and would like to secure the control of the manufacture and sale of some ready-selling articles, or would deal with an inventor who has a good thing, or would combine with some factory looking for new location, if line suits. Have well-equipped plant, plenty of ground, cheap coal and water, plant located between two belt railways, own siding, splendid shipping facilities both East and West. Address CONTROL, Box 773, New York.

Inquiry No. 6786.—For address of parties selling spool and bobbin machinery.

Inquiry No. 6787.—For manufacturers of small or portable furnaces (oil burner preferred) for smelting iron ore.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(9623) J. E. E. asks: Please answer in the question columns which is the more economical light, gas or electricity (incandescent) where the consumption is limited to a city of 10,000 inhabitants. I believe that for a city to own either a gas plant or a system of electric lighting, gas is cheaper, and will give a great deal more light for a given quantity than electricity. In fact, that electricity is a luxury. A. Whether gas or electricity is better for any given city is to be decided wholly by local conditions. If the proper gas coal can be had for a low cost at the place, gas may be cheaper. If water power can be had for generating electricity, or if steam coal is cheap in the place and gas coal is not cheap, then electricity would be better. The lighting by electricity is better than any other form of illumination.

(9624) W. J. McC. asks: What kind of an instrument can I make or buy to test that "a current of heat flows through a rod of metal, if the ends are kept at different temperatures, the flow being always from the high temperature to the lower," as is stated on page 122 of "Lessons in Electricity and Magnetism," by Silvanus Thompson, 1892. I require an instrument to show the above condition. A. A simple way to prove that a current of heat flows from a place of higher to a place of lower temperature along a bar of metal is by placing the fingers on the colder end and moving them along as far as it can be done without burning them. An ordinary thermometer may be used unless the bar gets too hot for it. Sometimes the bar is coated with paraffine when cold, and the melting of the paraffine is observed as it proceeds from the hot end toward the colder end. No special instrument is necessary to show that a bar is heated by the flow of heat along the bar. This flow is a current of heat.

(9625) W. J. W. says: Referring to No. 9594 under notes and queries in your issue of April 1, 1905, you state that no rivers on the earth flow up hill, on account of centrifugal force. If the mouth of the Mississippi River is farther from the center of the earth than the source, which it undoubtedly is on account of the shorter polar diameter, does not the river flow up hill? If not, please state your authority. A. Rivers unquestionably flow from one point to another point which is further from the center of the earth, but that does not mean that they flow "up hill." The definition of a level surface is one parallel at all points to the surface that a liquid, such as the sea, or the surface of any body of water not in motion, would take. This surface is not a part of that of a perfect sphere, but an oblate spheroid. Having thus defined a level surface, "up hill" would be defined as a direction deviating from it, going away from center of the earth faster than the level sur-

face. If you were to assume that the Mississippi River—or any other river flowing toward the equator—flows up hill, you would have to say that the level of the sea was not level, but was "up hill" toward the equator. This is contrary to ordinary usage, and not in accordance with the accepted definition of the words "level" and "up hill."

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Wrap, package, W. H. Pollock	787,465
Wrapping machine, A. E. Hopkins	787,379
Wrench, J. Delaney	787,350
Wrench, E. G. Overland	787,587
Wrench, L. G. Egger	787,741
Wrench, C. C. Longard	787,778
Yoke construction, N. H. Roe	787,642

DESIGNS.

Badge, W. H. Atkins	37,404
Clock support, W. E. McGraw	37,411
Dish, O. S. Straus	37,408
Electric light cluster, J. D. O'Bryan	37,410
Lamp, W. Gray	37,409
Spoon, B. D. Loring	37,405
Spoons, forks, or similar articles, handle for, W. C. Codman	37,406
Spoons, forks, or similar articles, handle for, R. von Hagen	37,407
Tiling, D. W. Austin	37,412
Type, font of, G. O. Ottley	37,413
Type, font of, W. A. Schraubstadter	37,414

LABELS.

"Academy," for boots and shoes, M. J. Mullen	12,056
"Crescent Mixed Paints," for mixed paints, Cawley, Clark & Co.	12,078
"Crown Phonograph Oil," for oil, T. C. Hough	12,074
"Diamond State Rye Whiskey," for whisky, L. J. Levy	12,067
"Flee-Flea Dog Soap," for dog soap, C. Koch	12,055
"H-Y-O-C-H," for a remedy for rheumatism, J. S. Young	12,053
"Jap-o-sine," for a color drier, Beckwith-Chandler Co.	12,076
"Josh Billings," for cigars, I. Lewis	12,069
"Lac-er-all," for varnish stains, Cawley, Clark & Co.	12,077
"Liquid Thyrinoids," for medicine, F. C. Reighter	12,061
"Livon Rice," for rice, American Rice Cereal Co.	12,058
"Old Hickory," for boots and shoes, M. J. Mullen	12,057
"Parsley Compound," for medicine, Guyer Medicine Co.	12,052
"Pine Tree Salve," for salve, Blewett Bros. Co.	12,054
"Puritan Wafers," for biscuits, crackers and wafers, Toledo Biscuit Co.	12,060
"Quickshine," for shoe dressing, E. Templar	12,072
"Royal Liquid Coffee," for liquid coffee, Royal Coffee Co.	12,066
"Salada," for tea, P. C. Larkin....12,061 to	12,065
"Pt Perkins," for whisky, G. Andreas & Co.	12,068
"Signal," for cigars, G. H. Maxwell	12,070
"Sunny Castle," for cigars and tobacco, Hausfeld & Huennekens	12,071
"Sure Grip," for a certain named preparation, L. J. Geipl	12,075
"The Katzenjammer Mixup," for a game, Fan Craze Co.	12,079
"The Kokolo Tonic," for medicine, J. L. Smith	12,080
"The Magic Curler," for hair curlers, Magic Curler Co.	12,073
"Violet Oats," for rolled oats, Albers Bros. Milling Co.	12,059

PRINTS.

"Bull Frog Brand," for India rubber hose, Toledo Rubber Co.	1,270
"Kneaded Everywhere," for flour, Washburn-Crosby Co.	1,268
"The Wonderful Electric Candy Machine," for candy machines, Electric Candy Machine Co.	1,269

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list. For terms and further particulars address Munn & Co., 361 Broadway, New York.